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EDITORIAL

Quality of Malayan Palm Kernels.

The growing importance of palm kernels from Malaya is a natural consequence of the development of the oil palm industry. The quantities of kernels exported are likely to increase considerably in the next few years as larger areas of the palms reach the bearing stage and the quantity of nuts produced justifies estates in installing machinery for the extraction of the kernel.

It is unlikely that extraction of oil from palm kernels will be undertaken in Malaya. Even the enormous African crop of kernels is shipped as such, to be crushed in the mills in Europe. It is important, therefore, that Malayan producers be informed of the quality of kernels desired by the crushers so that they may install suitable machinery for its production and perfect their technique accordingly.

The fact has early become evident that Malayan palm kernels command a slightly lower price on the European market as compared with the product from West Africa.

Doubtless the reduced price offered for Malayan palm kernels is partly accounted for by the relatively small quantities available. The price offered depends also on size and cleanliness of the consignment, colour of testa, colour of flesh and colour and acidity of the oil.

The subject is discussed in some detail by Major C. D. V. Georgi, O.B.E., in an article in this number under the title of "Malayan Palm Kernels".

The author shows from his investigations that the Malayan product is slightly superior to the West African kernels as regards oil content, but that the testa of the kernel is darker. This dark colour of the oil can be correlated with the pressure at which the fruit is sterilised and the artificial drying employed. It is shewn that the colour can be improved if the fruit is sterilised at a low temperature. It is admitted, however, that with the present system of treatment of the fruit, this desideratum is not always possible.

Seasonal Variation in Coconut Crops.

In an article in this number Dr. Jack discusses the question of seasonal variation in coconut crops, both by an examination of the annual net exports of copra and by the records of certain typical coconut estates. The results of this comparison of exports

and estate production agree very closely, the variation in the former being 6.9 per cent. and in the latter 6.2 per cent.

The number and size of nut varies from year to year, the variation of ripe nuts per palm is shewn to be 13.5 per cent. and of ripe nuts per acre from large estates 11 per cent.

The significance of these results is that the crops may be considered fairly steady as might be expected, since on account of its long maturation period, the fruit is not so dependent on weather conditions at any one time as are fruits with a shorter maturation period.

Malayan Pineapples.

The development of the Hawaiian pineapple canning industry, as will be seen by the short abstract appearing on another page in this number, has been of no accidental growth, but the result of a definite policy. The organisation which has been built up, and which has resulted in Hawaii becoming the most important producer of canned pineapples, has neglected no aspect of production and marketing which might result in economy of production or efficiency in marketing.

Reference to the report on the Malayan pineapple canning industry, published in the *Malayan Agricultural Journal* of September, 1931 indicates that the Malayan industry was brought into existence in very dissimilar circumstances and has developed along entirely different lines from those of Hawaii. Furthermore, Hawaii and Malaya are not in serious competition, as each caters for its own market.

We have to remember, however, that the Malayan industry has reached a turning point, so that present policy in cultivation and marketing will decide whether we shall retain and develop our present markets, or whether we shall surrender them in the face of the competition of the increasing choice of canned fruits from different parts of the world which are to-day offered to the public.

The recommendations of the Pineapple Conference are still under consideration, so that further comment at the present juncture is inopportune. Attention, however, is directed to the establishment of the Pineapple Experiment Station at Singapore. The Station is chiefly concerned with variety tests, cultivation, including experiments with mulch and manures, and possible systems of rotation in order to obtain data upon which the Malayan pineapple canning industry may be re-organised so as to rely less upon the produce obtained as a catch crop but rather upon a more permanent system of production.

Encouraging Padi Planting.

Attention is directed to an article describing a padi planting competition in Johore, which is contributed by an officer of the Malayan Civil Service—Mr. G. Hawkins.

The article is of interest in showing one method by which the research work of the Department of Agriculture filters through to the small-holder. In a covering letter, the author states that this experiment is an instance where the

administrative Land Office can execute the ideas of the advisory Department of Agriculture. He stresses the point that the Department of Agriculture "is not and never can be organised to do the actual donkey-work of planting. It is the business of the Land Office, which has the necessary staff and which should be held to strict account for neglect". He concludes—"My article is therefore merely a suggestion to other Land Officers of one method by which interest can be raised".

We would add that both the research and field officers of the Department are prepared at any time to assist Land Officers in the devising of schemes which have for their object wider interest in padi planting and the adoption of more effective and modern methods of cultivation.

Departmental Reorganisation.

During the year 1929 was commenced a series of changes in the internal organisation of the Department of Agriculture which aimed at increased co-ordination of the work of its various branches and extension of its activities.

The first step was a change in the title of the officer in charge of the Department from that of Secretary for Agriculture to that of Director of Agriculture. This change was made to mark the substitution of an officer with a professional training for an officer of the administrative service.

Towards the end of the year 1930 the Director submitted to Government, in accordance with instructions, comprehensive proposals for the reorganisation of the Department. That portion of them relating to the Senior staff has recently been approved by the Secretary of State for the Colonies.

Under the older organisation the Department was divided into nine Divisions with an officer at the head of each who was personally responsible to the Director. These Divisions were Agriculture, Botany, Chemistry, Entomology, Mycology, Plant Physiology and Soils, Agricultural Economy and Publications, Agricultural Instruction of Malay Officers, Field Division. This organisation was somewhat cumbersome and did not readily ensure co-ordination of work and mutual exchange of information without excessive attention to detail on the part of the Director. Under the new organisation the Department is divided into four Branches, namely, Research, Field, Agricultural Economics and Publicity, and Agricultural Education. The Head of each Branch is personally responsible to the Director for the work of the Branch and can thus relieve him of a considerable portion of the details and at the same time help to secure close co-operation of all Branches.

Under this scheme the Research Branch is divided into six Divisions which are identical with the first six Divisions mentioned above. At the head of each Division is an officer responsible to the Director through the Chief Research Officer. The duties of the latter are to supervise the detailed work of each Division and to ensure that the work of different Divisions on various aspects of problems common to two or more of them is properly co-ordinated.

The Field Division is organised on the basis of the various States and

Settlements. The Senior Field Officer in each is responsible to the British Resident or the Resident Councillor, as well as to the Director through the Chief Field Officer. The duties of the Chief Field Officer are to ensure uniformity and continuity of agricultural policy in the various States and Settlements on the lines laid down for him by the Director, to keep the Field Officers fully informed of the results of the work of the Research Branch and in touch with the other two Branches, and to ensure a full exchange of information among the various Field Officers themselves.

The Branch of Agricultural Economics and Publicity is in charge of the Agricultural Economist and deals with problems in agricultural economics, the collection of statistics, the editing and managing of Departmental publications and the maintenance of the Library.

The Branch of Agricultural Education is in charge of the Vice-Principal of the School of Agriculture at Serdang who is responsible for the training of the students at the School and for such vacation courses in agriculture as may be required for such officers as Assistant Headmen or Malay members of the Co-operative Department.

Earlier in the year 1931 revised salary schemes for Asiatic officers of this Department were also approved, and existing officers have, so far as is at present possible, been transferred to these new schemes.

While the various sections of the reorganisation proposals were under consideration, a change of bias was imparted to the activities of the Field Division as a result of which greater emphasis was given to the work of agricultural instruction which had previously occupied second place to that of agricultural inspection for the purpose of ensuring control of pests and diseases.

While the attention given to inspection work has not been diminished, the work of agricultural instruction has already been considerably extended. Additional appointments for both European and Asiatic officers of the Field Division have been provided and additional small Agricultural Stations and Padi Test Plots have been established in various parts of the country, while others will be opened up as financial considerations will permit.

In addition, a gradual extension of field experimentation supervised by officers of the Field Division is being effected. This is necessary as results obtained at Central Experimental Stations such as Serdang Experimental Plantation and Titi Serong must be tested under varying local conditions.

The above is a brief outline of the main points in the reorganisation arrangements in the Department. Owing to the exigencies of space a number of details have of necessity been omitted.

Original Articles.

MALAYAN PALM KERNELS

BY

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Acting Agricultural Chemist.

Introductory.

An investigation has been carried out recently regarding the present quality of Malayan palm kernels to ascertain as far as possible the reasons for the slightly lower price offered on the home markets for such kernels compared with the West African product.

Although it is probable that the reduced price is due partly to the relatively small amounts of local kernels now offering, since there is no free market for them compared with West African kernels, which are shipped in bulk, it was considered advisable to obtain information on the points to which attention is given when assessing the value of kernels. Estates can then modify their practice, as far as it is economically possible, for their product to conform as regards quality with the requirements of the home markets.

In this connection it may be mentioned that the exports from Malaya, which were approximately 500 tons for 1930, are insignificant compared with the 500,000 tons, annually exported from West Africa. As might be expected, therefore, Malayan palm kernels are practically unknown on the home markets, large buyers not being interested in the relatively small consignments which local estates have to offer. Representatives of one or two prominent firms belonging to the Liverpool United General Produce Association informed the writer last year that no consignments of Malayan palm kernels had come to their notice.

There is no doubt that in the early stages of production, estates tend to concentrate on palm oil rather than on kernels, which are regarded more in the nature of a by-product. This is due to the fact that the proportion of palm oil, which also has a much higher unit value, is much greater than that of kernels, the approximate figures being 30 per cent. of palm oil and 6 per cent. of kernels. Further, since the price of high grade oil is approximately double that of kernels it can be calculated that, allowing recoveries of 25 per cent. of oil and 6 per cent. of kernels, the relative values of the products for a given weight of fruit are in the proportion of 8 to 1.

It must be remembered also, that kernel production involves the following additional processes subsequent to the removal of the oil :—the separation of the nuts and fibrous residue in a screen, the drying and cracking of the nuts, the separation of kernels and broken shell, and the drying of the kernels. Small estates, especially in the early stages, are apt to regard kernel production as relatively expensive and it is probable, therefore, that, in an endeavour to reduce

expenditure in this respect, the quality may suffer owing to lack of attention during one or more of the processes.

There is also the additional risk of kernels deteriorating through storage on account of the fact that a small estate must allow its stock to accumulate for several weeks owing to shippers being unwilling to deal with consignments of less than 15 or 20 tons at a time.

Factors affecting Price of Kernels.

Apart from the size and cleanliness of the consignment and the oil content of the kernels, three factors must be considered when judging the value of kernels, namely, colour of testa, colour of flesh, and colour and acidity of oil.

As regards cleanliness, it is understood that oil mills do not object to a small proportion of shell, the presence of the latter assisting in the crushing of the kernels by preventing the rolls from becoming too oily.

From the point of view of oil content the presence of shell is a disadvantage, since the oil content of a consignment of kernels is based on the sample as received, no allowance usually being made for shell, dirt, or moisture. The price offered is based on an oil content of 49 per cent., a premium of 1½ per cent. being paid for each per cent. of oil in excess of that figure, while a deduction at a similar rate is made if the oil content is below the standard.

In this connection it may be mentioned that, although palm kernels, similarly to other oil seeds, vary in oil content, results obtained in this laboratory show that the oil content of local kernels is slightly above the average, provided the kernels are clean and have been well dried before packing.

The colour of the testa and of the flesh are important owing to the extent to which the colour of the residual cake or meal after removal of oil by expression or solvent extraction is influenced by a discoloration of the original kernel.

As is well-known, palm kernel cake is extensively used as an ingredient of feeding stuffs and buyers naturally prefer a light to a dark cake. Further, since with palm kernels there is a high proportion of residue for disposal, amounting to approximately 50 per cent. of the original weight of kernels, oil mills, which depend for their profits on the sale of cake, will also prefer the lighter kernel.

The colour of the oil is also influenced by the colour of testa and flesh and, while a dark oil is not of such great consequence as a dark cake, since for most purposes the oil must be bleached, there is little doubt that light coloured kernels are preferred.

The acidity of the kernel oil depends on two factors, proportion of broken kernels and moisture content of kernels on packing.

As regards broken kernels, there is a tendency for an increase in acidity of the oil as a result of the exposure of the flesh of the kernel to the air and the consequent risk of development of mould growth. Also, if kernels are packed moist, containing for example 10—12 per cent. of moisture, there is the additional risk of increase of acidity owing to over-heating and the possible development of a slight fermentation.

Collection and Analysis of Samples.

For the purpose of this investigation average samples of local kernels were collected from 13 estates, while the samples of West African kernels for comparative tests were obtained through the courtesy of the Malayan Information Agency.

With regard to the analysis, the tests were confined to determinations of the above mentioned factors affecting the price, the local kernels being examined both when freshly collected and after a period varying from 3 to 4 months in order to obtain an indication of any changes taking place as a result of storage. The period of storage was chosen to coincide approximately with the average time elapsing between preparation on the estate and sale on the home market.

A given weight of kernels, approximately 2,000 grammes (4½ lbs.), was selected at random from the estate sample and placed in a small sack, the latter being hung in a rat-proof wire cage during the period of the storage.

From the balance of the estate sample 100 kernels were selected at random and each kernel cut in half in order to judge the colour of the flesh. The remainder of the kernels was crushed between rolls, the material being pressed in a small laboratory hand-press to obtain a sample of oil for the determination of acidity.

After the period of storage, the kernels were weighed and a sample drawn for the determination of moisture, a similar procedure to that employed with the fresh kernels was adopted as regards judging the colour of testa and flesh, also the acidity of the oil.

The moisture content of the stored kernels was between 8 and 9 per cent. In this connection, therefore, it may be mentioned that, provided kernels have been well dried before packing, the loss in weight in transit to Europe should not exceed 4 per cent., the average moisture content of kernels at home being approximately 5 per cent.

In a few cases, the kernels were found to have been attacked by insects, due either to old rice sacks having been used in making the small storage bags or to infection from a sample taken on one estate where a large heap of old insect-ridden kernels was found.

Since insect-attack of palm kernels has not been noticed previously and is probably due to the fact that in order to reduce expenditure estates are now packing kernels in second-hand rice sacks instead of new sacks, the insect-ridden kernels were excluded from the tests, although they were tested separately for determination of the acidity of oil.

Results of Analysis.

Since it is well known that the colour both of the testa and the flesh of the kernel is affected by the particular treatment adopted at certain stages of the factory process, (i) sterilisation of the bunches or the clean fruit, (ii) drying of the nuts preparatory to cracking, the results of analysis given in the table have

RESULTS OF COMPARATIVE TESTS OF MALAYAN AND WEST AFRICAN PALM KERNELS.

Country of Origin.	Serial Group.	No. of Estates.	Colour of Testa	Colour of Flesh of Kernel.						Acidity of expressed Oil. (calculated as lauric acid per cent.)		
				Proportion of white kernels.			Proportion of off-colour kernels.					
				Maximum per cent.	Minimum. per cent.	Average per cent.	Maximum per cent.	Minimum. per cent.	Average per cent.	Maximum	Maximum	Average
Malaya	A	1	Very dark colour			75 *54*			25 *46*			0.1 *0.8*
Malaya	B	3	Very dark colour	85 *82*	50 *50*	64 *62*	50 *50*	15 *18*	36 *38*	1.8 *2.5*	1.6 *1.5*	1.7 *2.0*
Malaya	C	4	Dark colour	95 *95*	68 *65*	83 *81*	82 *35*	5 *5*	17 *19*	1.9 *2.8*	0.9 *1.2*	1.5 *2.3*
Malaya	D	5	Dark colour	99 *99*	79 *72*	90 *84*	21 *28*	1 *1*	10 *16*	1.9 *3.1*	0.4 *1.2*	1.0 *2.1*
West Africa, Bulk sample.			Dark colour comparable with Malaya C. & D.			57			43			5.9
West Africa, Sierra Leone sample.			Light colour			82			18			2.4
West Africa, Port Harcourt sample.			Light colour			92			8			2.2
West Africa, Sapele sample.			Light colour			76			24			2.5

N.B. The figures in italics are for the stored kernels and correspond to those for the fresh kernels given above in each case.

been classified according to the variations in those parts of the process, estates practising similar treatment being grouped together as follows:

Serial Group Letter.	No. of Estates.	Essential Details of Process.
A	1	(i) Sterilisation of fruit bunches under steam pressure, 40 lbs. per sq. in. (ii) Artificial drying of nuts.
B	3	(i) Sterilisation of fruit bunches under steam pressure, 40 lbs. per sq. in. (ii) Air-drying of nuts in heaps.
C	4	(i) Sterilisation of fruit under slight steam pressure. (ii) Air-drying of nuts in heaps.
D	5	(i) Sterilisation of fruit with open steam. (ii) Air-drying of nuts in heaps.

Observations on Factory Process.

Bunch sterilisation, which is the method at present adopted on all large oil palm estates, consists in heating the bunches in a sealed vessel for approximately one hour under a steam pressure of 40 lbs. per square inch with the primary object of loosening the fruit and facilitating separation in the mechanical bunch stripper.

The method of sterilising the fruit under slight steam pressure has been adopted by certain estates in preference to the original method of treating with live steam, in order to prevent the wastage of steam occurring when the fruit is merely steam-heated in vessels without tightly-fitting lids.

As is well-known, the effect of heating under pressure results in the temperature being raised, in the case of a steam pressure of 40 lbs. per sq. in. the temperature would be approximately 140°C., for 10 lbs. per sq. in. 112°C. If live steam is used the temperature will not rise above 100°C., the boiling point of water.

The artificial drying of the nuts is usually effected by exposing the clean nuts from the depericarper to the action of the hot flue gases from the boiler furnace, the nuts moving along a conveyor during the operation. In view of the variation in the temperature of the flue gases, such a method calls for close supervision on account of the possibility of exposing the nuts for too long a period to an excessive temperature with consequent discoloration of the kernel.

The method of drying nuts in heaps* consists in storing the clean moist nuts from the depericarper in heaps in an airy shed protected from rain for 10 to 12 days. During this period a certain amount of heating occurs and the nuts, with the exception of those in the top of the pile, dry. While in this method the degree of heat is not so great as in the artificial method, the period of heating is much longer. In this connection, also, it is important to note that the nuts should not be heaped for more than 12 days, a longer period of storage

* *Malayan Agricultural Journal*, Vol. XVII, No. 10, p. 367.

resulting in an increase of discoloured kernels.

Consideration of Results of Analysis.

Colour of Testa.—The results of analysis show that the colour of the testa of Malayan kernels is darker than the West African. Further, there appears little doubt that the darkening of the testa can be correlated both with the pressure at which the bunches or the fruit are sterilised and the artificial drying of the nuts.

In this connection, experiments carried out in this laboratory have shown that if the clean nuts are heated to a temperature of 140°C for a period of half an hour, both the testa and the flesh of the kernel tend to darken. Although the comparison is not strictly accurate, seeing that nuts were used in the experiment, it is reasonable to suppose that a similar tendency to darken would be noticeable in the case of bunches or fruit heated under pressure. The darkening would also become more marked if the nuts were exposed to excessive heat in the artificial dryer.

It must be admitted, however, that even when the fruit is sterilised with live steam and the nuts dried by exposing them on a cement floor to the sun, the proportion of kernels having light-coloured testas compares unfavourably with that found in the best West African samples. It appears, therefore, that the colour of the testa of the Malayan kernel, even when extracted under the optimum conditions, is darker than that of the West African.

The darkening may possibly be due to some inherent feature of the local fruit, such as, for example, the higher proportion of pericarp with its corresponding increase in the amount of fruit juices containing gummy and other water-soluble organic substances. These juices may darken on heating, possibly interacting with the material composing the shell, penetrating through the latter, affecting thereby the colour of the testa. This possibility will be referred to again when discussing the colour of the kernel.

It is also possible that owing to the naturally firm adherence of the testa to the inside of the shell, any darkening of the material composing the shell on heating, might cause a corresponding darkening of the testa, especially in view of the moist nature of both shell and kernel.

It is difficult to suggest a remedy for this darkening, which is due to the somewhat different policy regarding the treatment of oil palm fruit adopted in this country compared with parts of West Africa, the primary object of every Malayan estate being to obtain the maximum recovery of high quality oil. It is out of the question to suggest any modification of the present sterilisation procedure which is undoubtedly the most essential feature of the whole process.

As far as could be judged there was no tendency for the testa to become darker on storage.

Colour of Flesh of Kernel.—With regard to the colour test for the flesh of the kernel, the results of analysis show that sterilisation under pressure, together with artificial drying of the nuts, is apt to affect the colour considerably.

The darkening may be due to two causes (i) a slight decomposition of the kernel owing to the relatively high temperature (ii) penetration of coloured fruit juices and palm oil into the kernel.

There is little doubt that the temperature of sterilisation affects the colour since, in addition to the experiments carried out with nuts referred to previously, other investigations have shown that with increase in pressure there is also a progressive increase in the degree of discoloration of the kernels. For example, if fruit is sterilised at a steam pressure of 30 lbs. per sq. in. (130°C.) the proportion of discoloured kernels is negligible, with the steam pressure at 40 lbs. per sq. in. (140°C.) there is a fair proportion of brownish kernels, while raising the steam pressure to 50 lbs. per sq. in. (150°C.) results in practically 100 per cent. discoloration.

It is unfortunate, therefore, that it should be necessary to treat the fruit bunches wih the steam pressure at the critical point in order to ensure satisfactory separation of the fruit and to assist in the loosening of the kernel within the shell.

Further, it is well-known that in sterilisation, especially under increased pressure, diffusion of both fruit juice and oil into the kernel may occur. For example, in the case of the sample in Group A 15 per cent. of the kernels were definitely stained with palm oil.

The effect was particularly noticeable when bunch sterilisers of the vertical type were used, especially in the fruit in the bunches at the bottom of the steriliser. The full effect of the superimposed mass of bunches was obtained and there was also the additional chance of the kernels being affected on account of the fruit being immersed in the mixture of oil and condensate collecting there.

In order to eliminate the action of the iron on the fruit juices resulting in a considerable darkening of the latter it was proposed at one time to galvanise the linings of sterilisers.

In Sumatra it is stated that a remedy for the discoloration is to be found in the application of a vacuum after sterilisation, the vacuum being induced by means of a steam jet. This also has the effect of reducing the moisture content of the material, and the somewhat dark condensate issuing from a steriliser shows that such treatment probably removes a certain proportion of the soluble colouring matter. Experiments on these lines will be carried out.

The application of vacuum is, however, really only practicable if the press system is being used for the subsequent treatment of the fruit. It would not appear to be an economical proposition in the centrifugal system to remove moisture, when at the next stage of this process, the digestion of the fruit, large quantities of steam must be injected to assist in the disintegration of the mass.

If the fruit is sterilised at low pressure or treated with open steam, the percentages of off-colour kernels compare favourably with those found for the West African samples.

Further, the results also show that the colour of the kernels is unlikely to be affected to any considerable extent by drying the nuts in heaps, provided that

clean nuts are piled and heaps are not allowed to remain for more than 10 to 12 days before breaking.

With the exception of the single sample in Group A, the percentage of off-colour kernels shows no tendency to increase on storage. It is thought that in the case of this sample the increase is due to the discoloration becoming more marked as the kernels dried. The moisture content of the fresh kernels was approximately 14 per cent., while that of the stored kernels was between 8 and 9 per cent. Further, most of the kernels adjudged off-colour were only very slightly discoloured.

Acidity of Oil.—The figures for the acidities of the oil from both fresh and stored kernels, call for little comment, being well within the range of the best West African samples. A noticeable feature of the series is the extremely low acidity figure for the oil from the estate in Group A.

A large increase in the acidity of the oil after storage of the kernels was not expected on account of the very small proportion of broken kernel present in average Malayan consignments. This is due partly to the grading of the nuts before cracking and partly to the practice on estates of selecting kernels before packing, all fragments of shell and badly broken kernels being removed.

As regards acidity of the oil, the figures for insect-ridden kernels were in all cases considerably higher than those for good kernels, the average figure being approximately 4 per cent., calculated as lauric acid.

Remarks and Conclusions.

Since external colour appears to be an important criterion in assessing the value of kernels, it must be admitted that Malayan palm kernels do not reach the standard of the best West African consignments.

The internal discoloration of the Malayan palm kernel is due to the degree of heat to which the fruit is subjected at certain stages of the process, the primary object of which is undoubtedly the maximum recovery of palm oil, the more valuable of the two constituents of the fruit. By reducing the degree of heat the quality of the local kernels as regards this factor compares favourably with that of West African consignments.

It is possible that the tendency to discoloration is more marked in local fruit than in West African on acount of the higher proportion of pericarp in the former.

Suggestions are offered for improving the colour of the local kernels where it is difficult to avoid the development of discoloration, but it is doubtful whether the adoption of the method is practicable in view of the subsequent treatment.

The acidity of the oil does not appear to be affected by the discoloration.

The investigation has shown the possibility of the kernels being attacked by insects due to second-hand sacks being used for packing. Damage by insects can be avoided if all sacks before use are sterilised with steam, preferably at a high pressure.

ANNUAL VARIATION IN COCONUT CROPS

BY

H. W. Jack.

Economic Botanist.

Annual or seasonal variation in fruit crops has been experienced in every country and is generally accepted by agriculturists and investors as inevitable. The amount of variation which is found with any particular crop fluctuates considerably according to environmental conditions, of which soil and climate are the main factors.

The variations in the coconut crop from year to year are of vital interest to estate managers who endeavour to forecast crops, to estate directors and investors as affecting dividends, and to various agencies connected with the treatment or transport of copra, and consequently these few notes may be useful as well as interesting.

For the most part, coconuts are cultivated commercially only in those regions near the equator where weather conditions are fairly equable, and a year elapses between the fertilisation of the coconut flower and the full maturation of fruit, so that the fruit is exposed to weather conditions for a much longer period than most commercial fruit crops grown in temperate or even in tropical countries and is therefore probably not so dependent on immediate weather conditions at any one time as those crops the fruit of which ripens in a much shorter period. Hence, coconut crops show a smaller annual variation owing to the comparative evenness of the climates in which they are grown, than most fruit crops cultivated in the more variable weather conditions, which are so characteristic of temperate regions.

Thus, in Ohio, (1) production records show that the average annual variations of the apple crop for the ten year periods 1908-17 and 1917-26, were 46 and 39 per cent. respectively, of the mean crops for those periods. Similarly, in a tropical country such as Trinidad, (2) the cocoa crop on an estate, for the period 1914-29 showed an average variation of 25 per cent. from the mean, which is a much higher figure than the coconut crop in Malaya, probably partly due to the fact that the cocoa pod ripens within six months after the fertilisation of the flower.

The average annual variation in copra production in Malaya (600,000 acres under coconuts) from large areas is indicated in Table 1, which gives the net annual exports of this commodity for nine years, the mean export, the deviations therefrom and the mean deviation which, expressed as a percentage of the mean export, is 6.9 per cent.

Table I.

Variation in Exports of Copra and in Average Production of Copra Per Acre.

YEAR.	Annual net exports of from copra Malaya.	Difference from Mean.	Average production of copra per acre from 30 estates.	Difference from Mean.
(1)	(2)	(3)	(4)	(5)
	Tons		Pikuls	
1922	104,588	6,217	7.88	1.00
1923	96,657	7,684	8.79	.08
1924	91,877	6,464	7.87	1.01
1925	96,544	1,787	8.51	.37
1926	104,653	6,312	8.81	.07
1927	86,649	11,692	9.85	.97
1928	95,091	3,250	8.67	.21
1929	112,698	14,357	9.54	.66
1930	102,330	3,989	10.01	1.13
Total	885,067	61,752	79.93	5.50
Mean	98,341	6,861	8.88	.55
Percentage of Mean		6.9	Percent. of Mean.	6.2

Variations in the net exports may be due to factors in addition to those affecting yields, such as price of the commodity, supplies from other countries etc., but local production should always be the dominant factor and hence the exports reflect, to a fair extent, the annual variation in cropping. In the same Table, the average production of copra per acre per annum from thirty estates under European management representing some 56,000 acres distributed over the main producing areas in the Federated Malay States is given in pikuls (1 pikul = 133⅓ lbs.) as well as the mean production over the whole period

The annual differences from the mean production are shown in column 5 as well as the mean of those differences which is 6.2 per cent. of the mean yield per acre, and approximates to the figure already given for variation in net exports. The increasing age of the palms on the estates, together with the tendency for copra prices to drop, coupled with efforts to increase production indicate a slight upward trend in the average production which possibly slightly magnifies the variation due to seasonal causes during the period under consideration. On the other hand, the estates cover such a wide range of variable environmental and seasonal conditions that the cropping variation is probably modified to such an extent as to outweigh the factors tending to increase yields. Hence the variation shown (6.2 per cent. of the mean) affords a fair indication of variation over large and widely distributed areas and is, of course, liable to be greater or less than the mean in any year, so that between any two consecutive years there may be a variation of approximately twice the amount shown, as was indicated by the writer (3) several years ago.

Table II.

Annual Yield of Fruits per Palm from Row 9 Palms 1—12 of the Experimental Area.

Palm No.	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	Mean	Total deviations from Means	Average deviations from Means	Average deviations as o/o of Means.
1	71	67	41	74	57	77	62	65	77	72	66	81	8.1	12.3
2	76	54	55	53	45	74	57	64	60	73	61	85	8.5	13.9
3	100	71	87	95	82	92	84	106	87	103	91	85	8.5	9.3
4	63	44	58	51	60	58	38	40	41	39	49	88	8.8	17.9
5	80	83	98	89	59	73	70	77	64	62	75	99	9.9	13.2
6	109	75	78	77	62	53	71	91	58	77	75	96	9.6	12.8
7	122	91	66	105	54	90	92	110	113	91	93	152	15.2	16.3
8	79	58	91	74	93	76	71	87	88	99	82	100	10.0	12.2
9	63	60	43	45	40	38	47	60	73	61	53	104	10.4	19.6
10	74	50	63	61	54	74	46	82	60	54	62	93	9.3	15.0
11	52	51	62	57	68	65	60	77	77	62	63	69	6.9	10.9
12	73	68	66	64	63	57	55	63	52	73	63	54	5.4	8.6
Totals	962	772	808	845	737	827	753	922	850	865	69	92	9.2	13.5
Average per ann.	80	64	67	70	61	69	63	77	71	72	69	44	4.4	6.4

Table 2 shows the individual yields of fruits recorded annually from twelve consecutive mature palms growing in a line under good average estate conditions for ten years. The mean yields are given in column 12. In column 14 the average deviations from the mean yields are shown and these are expressed as percentages of their means in column 15, which shows a range of from 8.6 to 17.9 per cent. with an average of 13.5 per cent.

At the bottom of this table the average annual yields from the group of palms are given, as well as their mean for the period, the deviations therefrom and the average percentage deviation from the mean is shown to be 6.4 per cent. Thus, for individual palms growing under good conditions, the average annual variation in yield is shown to be 13.5 per cent. of the mean yields; whereas if considered as a group, the average annual variation is only 6.4 per cent. which very closely resembles the variations shown in Table 1. Many other groups of palms on the experimental area for which figures are available could have been chosen with similar results. Incidentally, the Table also shows that individual palm yields are fairly constant over a long period. In the case of individual palms selected as high yielders, ten scattered palms on the experimental area having an average of 97 fruits per palm per annum over a period of ten years, gave a slightly higher average variation amounting to 14.4 per cent. of the mean yield. This tendency for variations to increase according as yields increased has already been recorded (4).

In Table 3, the annual crops in ripe nuts per acre from long-established blocks of palms on four estates situated in three different areas representative of the main commercial copra-exporting districts of Malaya, are shown. The estates concerned were chosen for several reasons. They fairly represent the varying conditions of soil and water-table in our oldest established commercial coconut areas, they are known to be high-yielding estates, they are under European management, and the managers in charge of them are noted for their keenness and reliability, so that the figures provided by them are comparable and accurate within the limits of practical estate work. The yields are given for the longest periods possible in each block and are all from mature bearing areas only. The mean yields per block, the average annual deviations from those means in numbers of nuts per acre and as percentages of the mean, are shown for each block, and the mean percentage deviation of all the blocks is found to be 10.44 per cent. (with a range of from 7.5 to 15.9 per cent.). Thus, the average annual variation in cropping on well-managed estates under good conditions, as judged from the data in this Table, is less than 11 per cent. of the mean yield over fairly long periods. Again, this variation may exceed or be less than the mean by this average amount, so that in consecutive years there may be differences in actual crop of approximately twice the average or even more as can be seen by comparing the yields in estate C, block 2, for the years 1916 and 1917 where there is an increase in crop in 1917 over 1916 of approximately 21 per cent. Incidentally, this table also shows that excellent crops are maintained under local cultivation conditions (alluvial clay soils) for at least twenty years after the

Table III.

Annual Crops in Nuts per Acre from Estates.

	Estate A.			Estate B.	Estate C.				Estate D.
Block	1	2	3	1	1	2	3	4	1
Area	Acres 52	Acres 56	Acres 47	Acres 75	Acres 103	Acres 294	Acres 211	Acres 315	Acres 253
Planted	1903	1907	1909	1910	1900	1901	1902	1906	1911
1913	—	—	—	—	3616	3746	2966	—	—
1914	—	—	—	—	3745	4147	3263	—	—
1915	—	—	—	—	3314	3392	2775	—	—
1916	—	—	—	—	4002	3772	3362	2827	—
1917	4028	3364	—	—	4496	4574	3950	2774	—
1918	4282	4484	3689	—	4475	4408	3233	2524	—
1919	3782	3420	2343	—	2819	3029	2969	2932	—
1920	3136	3517	2877	2758	3642	4068	3771	3359	2921
1921	5478	4559	4073	3029	4930	3974	3439	2882	3235
1922	4147	3711	3668	3735	3818	3907	3909	3124	3401
1923	4077	3609	3704	3264	4215	3849	3423	3387	3079
1924	4586	4847	5010	2737	3084	3605	3269	3306	3284
1925	4488	4406	4400	3246	3561	3591	4046	3032	3634
1926	4654	5003	4676	2929	3489	3721	3547	2863	3614
1927	3955	4223	4183	2966	3345	2933	3291	3000	3447
1928	3370	4763	5158	3346	4445	3056	3315	3015	4042
1929	4254	3933	4722	3740	2796	3017	3144	3692	3709
1930	4521	4852	4791	3352	3134	3012	3270	3227	3825
Total	58758	58781	53294	35102	66926	65801	60942	45947	38191
Mean	4197	4199	4100	3191	3718	3656	3386	3063	3472
Average deviation from M	412	520	653	280	487	401	265	229	266
Percent. average deviation M.	9.8	12.4	15.9	8.8	13.1	11.0	7.8	7.5	7.7
Total percentage deviations from means = 94.0					Mean percentage deviation = 10.4				

palms have become mature, with, as yet, little sign of diminution in yields. Thus, it has been shown that, in large areas of coconuts, as may be gauged from the copra exports and from the average yields of a fair number of well-managed estates, there is an annual variation in yield approximating to 6 to 7 per cent. of the mean over a fair period. Individual estates show an annual variation of 10.6 per cent. with a range of from 7.5 to 15.9 per cent. of their mean production, while individual palms exhibit a mean annual variation of 13.5 per cent.

Variations of the order described cannot be considered as large and consequently, it may be said that, on the whole, coconut crops in Malaya are fairly steady as compared with many other fruiting crops, and that under fair average

conditions of cultivation, they merit, as far as production is concerned, the title of "Consols of the East", though the last few years have shattered sadly their claim to that title in relation to market prices.

Summary.

1. The average annual variation in copra production in Malaya is shown to be 6.9 per cent. of the mean production (98,341 tons).
2. The average annual production of copra per acre on large estates is shown to vary by 6.2 per cent. of the mean production (8.88 pikuls)
3. The average annual variation in production of ripe nuts per palm per annum is shown to be 13.5 per cent. of the mean production per palm.
4. The average annual variation in production of ripe nuts per acre from large estates is approximately 11 per cent. of the mean production per acre.

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A MOLE—DRAINING EXPERIMENT

BY

N. H. Sands,

Attached to Department of Agriculture, Kedah.

The quick removal of rain-water from aerodromes, race and golf-courses without interfering with, or damaging, the surface of the soil is often most desirable, especially during the periods of the year when the rainfall is heavy.

An experiment, with the object of running off surplus water rapidly from the surface of the large aerodrome at Alor Star, is being carried out by the Public Works Department, Kedah by the method known as mole-draining.

The Alor Star aerodrome covers an area of over 1,000 yards by 1,000 yards and is regularly used by both heavy and light aircraft. It is almost level, there being a slope of only 4 feet from north to south. The subsoil is a stiff clay. The surface of the soil is somewhat lighter and has consolidated well. After heavy monsoon rains water collects on the surface to a depth of 1—3 inches, and owing to the slight slope and plastic nature of the soil, natural drainage is very slow. In view of the above-mentioned conditions it was found necessary to drain the land artificially.

At the outset large open drains were constructed along each side of the area and a large subsoil drain diagonally across it. From the latter, secondary subsoil drains were made and between these, mole-drains were run 30 feet apart and 8 inches to 1 foot deep. The mole and the main sub-soil drains empty water into the large open side drains which surround the aerodrome.

The system of mole-draining consists of drawing a steel bullet or "mole" some 2 inches in diameter and 16 inches long through the subsoil in a horizontal direction, thus forming a small tunnel through which water can pass.

The details of the construction of the implement are as follows :—

Two parallel iron bars 7 feet long are attached to each other, side by side, and slide on the surface of the soil. Between these a thin disc-coulter is attached which cuts through the soil to a depth of 6 inches only. Behind this there is a vertical blade, at the base of which the mole is fixed.

A series of holes in the blade enables the mole to be set and the drains made at the required depth. Attached to the blade and the base of the handle is an adjustable rod which ensures that the blade is held in a vertical position. The handle is held in check at the base so that it cannot move forward, but when it is desired to run the drainer out of the soil, the handle is forced backwards and the mole is gradually drawn to the surface.

Three small wooden rollers, each 9 inches in diameter, are fixed to the implement, two being placed in front and one behind.

It is stated that a draw-bar pull of some 3,000 lbs. is required to draw the drainer through the soil, and this power is obtained from a light tractor with a steel-wire hawser and winch.

When starting drainage operations, the mole is inserted at the side ditch and the tractor proceeds ahead paying out 100 yards of cable. The tractor is then jacked up quickly by a simple device and anchored. The engine turns the winch slowly and winds in the cable, thus drawing the mole through the soil. The whole process of inserting the mole and winding in the 100 yards of cable takes about 10 minutes. When one of the main drains is reached, the mole is run out and the whole implement is then lifted into the tractor and carried back to the side drain at the required distance from the drain last made.

No soil is removed in the process and the surface of the land is not disturbed. It is important to note that the cut made by the coulter and blade is not intended for the passage of water from the surface to the mole-drain. Under normal weather conditions this small opening should close, otherwise there is danger of the drain being blocked by falling earth. The back-roller already referred to assists in closing the small cut.

The shallower the moles are run the sooner do they run off surface water, but they are more liable to collapse under heavy pressure. A depth of drainage of 14 to 16 inches with drains 6 to 21 feet apart is usually considered to give the best general results. At these distances the mole-drains can be run up to 200 yards long, but the slope of the land must, of course, be taken into consideration when laying out the scheme of operations.

Care should be taken to see that the outlets of the mole are kept open, and a good idea is to insert in them a short length of piping. At the aerodrome this was at first not done and a number of the outlets quickly choked.

The best time for mole-draining is when the surface soil is dry and the subsoil wet. Again, unless the moles are run at least 2 to 3 inches deep in a stiff subsoil they will not last long.

Moles up to 6 inches in diameter are sometimes made at depths of 20 inches to 30 inches, but considerably more power than can be obtained from the average tractor is required to make them.

The cost of the whole equipment, that is, tractor, mole-drain, and accessories used at the aerodrome was $2,300. The mole-drainer with cable costs about $300. The cost of working the equipment per day of 8 hours is $7.50 and the cost per acre is $2.30 with drains 30 feet apart and 8 inches to 1 foot deep. These costs may be reduced when further experience in handling the equipment is obtained.

In conclusion, it can be stated that mole-draining can be effectively carried out on areas such as described, and that with closer drainage than that at present practised at the aerodrome—namely 15 to 20 feet as against 30 feet, a greater measure of success will be obtained.

Th writer is much indebted to Capt. G. Walker, O.B.E., M.C., State Engineer and Mr. C. E. Jenkins, Senior Executive Engineer, Kedah, for information regarding the drainage scheme and for the facilities given him for witnessing the work in progress.

SIDE VIEW OF THE MOLE-DRAINING IMPLEMENT LIFTED TO SHOW ITS GENERAL CONSTRUCTION.

THE MOLE-DRAINER IN OPERATION.
NOTE THERE IS LITTLE DISTURBANCE OF THE SURFACE OF THE SOIL.

K. P. CO. LTD.

Abstracts.

THE CANNED PINEAPPLE INDUSTRY IN HAWAII*

Pineapple plants were successfully introduced into Hawaii in 1809, but it was not until 1885 that a number of varieties were introduced, amongst which the Smooth Cayenne proved so superior, as to lead almost to the exclusion of all other varieties.

In view of the fact that Hawaii is some 2,000 miles from the nearest United States port, it was practically impossible to find a sufficiently large market for the fresh fruit, in consequence of which the first canning venture on the islands was instituted in 1892.

Seven years later, the initiative of one man led to an extension of this small industry, the subsequent rapid development resulting in the Hawaiian Pineapple Company being inaugurated in 1901. Other companies soon followed the lead, until by 1912 the production exceeded consumption. In that year, the "Association of Hawaiian Pineapple Packers" was formed mainly for the purpose of strengthening the market conditions for canned Hawaiian pineapples through united advertising.

This move resulted in increased consumption; the development of the industry surged ahead until in 1930 nearly 13,000,000 cases, each of which contains an average of two dozen cans, were produced.† The American Can Company supplying cans for all the industry reports a consumption of 45,000 tons of tinplate in 1930.

The main crop is obtained from six of the main islands of the group, namely Kanai, Oaku, Molokai, Mani, Lanai and Hawaii, the total area under the crop being 78,000 acres.

The pineapple plant "possesses a relatively high moisture content and nutrient absorbing capacity in its leaves and axillary roots. Its adaptability to environmental changes may be judged from the fact that in Hawaii it is grown successfully in altitudes varying from nearly sea-level to 3,000 feet, in regions of rainfall from 15 to 100 inches a year, in temperatures that vary from 45°F to 100°F and in varying sunlight intensities as well as numerous soil types. The best pineapples, however, and by far the majority, come from regions of equitable climate, between the altitudes of 500 and 1,500 feet".

Early attempts to foster better pineapples by means of irrigation were unsuccessful, mainly because the plants suffered from stagnation or overbundance of soil moisture. It has been shewn that the pineapple is an efficient user of water. It requires only 25 lbs. of moisture to build up 1 lb. of dry matter.

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*An Abstract of an article by Norman King of the Association of Hawaiian Pineapple Canners, published in *Tin*, November, 1931.

†The Malayan production for 1930 was 1,618,919 cases of 4 dozen cans per case so that Hawaiian production is nearly four times that of Malaya.

Considerable preliminary cultivation of the land is practised in Hawaii before planting the crop. Leguminous and other crops are also grown for a period of one or two years between crops of pineapples to rejuvenate the soil and are then ploughed in.

Before planting, long strips of heavy tar paper mulch are laid over the fertilised beds. Approximately 24 such rolls, varying in width to suit different requirements, between 36 inches and 54 inches wide, are required per acre. The purpose of paper mulch is to prevent excessive growth of weeds, to conserve moisture when it is scarce and to shed it when rainfall is excessive, and to increase the temperature of the surface soil during the early stages of growth and thus accelerate plant development.

The planting operations are done by hand. A hole is made through the paper 8 inches into the soil and the "seed piece" is thrust therein. In this way 15,000 to 20,000 plants per acre are set.

Manuring is an important feature in Hawaiian pineapple cultivation. As a general rule, 0.1 lb. per plant of a complete fertiliser is applied under the paper at planting time, an equal quantity, if not more, applied subsequently, either in the ground, or more commonly in the basal leaf axils of the plant. The latter system is recommended.

Thus 3,000 to 4,000 lbs. of fertiliser per acre are required. This appears excessive, but is not so considered in view of the heavy first crop obtained of 30 tons per acre, while close on 50 tons per acre has been known.

It has been found that the pineapple plant responds to iron salts. Consequently, scrap iron is treated with sulphuric acid, forming iron sulphate crystals, which are dissolved in water and sprayed on the plants as a dilute solution.

The pineapple crop in Hawaii is subject to various pests and diseases, amongst which heart-rot, thrips and "wilt" are mentioned.

Approximately 80 per cent. of the fruit ripens in July, August and September. In order that the fruit may be "picked ripe and canned right", the utmost speed in transportation from the fields to the canneries is necessary.

Special machinery is used for the treatment and canning of the fruit and the utilisation of the waste to ensure that the factory work shall keep pace with the heavy crop in the season.

The Association of Hawaiian Pineapple Canners has inaugurated an Experimental Station, staffed with a number of specialists. In a few years they have "contributed substantially to a knowledge of soil and plant compositions, insect associations and control, the development of new and more resistant varieties of pineapples, root damaging nematodes, plant assimilabilities and growth habits, and pathogenic organisms injuring pineapples. The department of agronomy conducts field experiments with an eye to determining field applicability of laboratory findings."

THE WHALE OIL INDUSTRY IN 1931.

Regarding the heavy competition last year with whale oil against palm, coconut and other vegetable oils, it is interesting to note that, according to the Cape Town correspondent of the (London) *Morning Post,* this newcomer should be less aggressive during the coming season, as we are told—

"A comparatively small fleet of whaling vessels will proceed to the Antarctic this season from Cape Town, which is now the centre of the world's whaling industry. Only three companies will operate this year, the total fleet comprising seven factory ships and about forty whale-catcher ships. Last year the fleet consisted of forty-five large factory ships and more than 200 catchers—the largest whaling fleet ever assembled. The Norwegians decided not to participate this year owing to the whale-oil glut. At least one company has gone into liquidation.

"Hundreds of skilled whale-fishers are now idle in Norway, and it is more than probable that when the big fleets again sail into the Antarctic next year the harpoon gunners, who made small fortunes in the past, will have to accept a lower rate. Indeed, this has already come into operation, and many of the gunners who have just sailed in the small fleet this year have signed on at only £3. 15s. for each blue whale they shoot, as against £6 in the old days. Even so, however, with a catch averaging 200 whales for each ship they will still be able to earn a sum for their seven months' work far in excess of the average liner captain's yearly pay.

"The three companies who are operating this year are mostly catering for the private requirements of various soap-making concerns, and it is expected that only about 50,000 tons of oil will be needed. This will mean the killing of approximately 3,000 whales—a small number when compared with the 40,000 that were slain last year. The reason for this terrific slaughter was that the Antarctic fields were comparatively new, and it was feared that the whales would soon vanish. Thanks to recent scientific expeditions, however, it is now known that the whales exist in large numbers all around the South Polar Regions, and there is no fear of a shortage for many years to come. In future, therefore, it is likely that only sufficient oil to fulfill the world's requirements will be taken to avoid over-production".

Those words "the reason of this terrific slaughter", reminds one of the hopes advanced by the Vegetable Oil—Producer (without destroying life) that some international arrangement will be arrived at to regulate the massacre of the whales, especially during the breeding season or in certain waters, some say the tropical seas, where the whales go to have their offspring. Failing such measures it is reckoned that a few more seasons like the last will see the end of the whale, and hence of their competition with vegetable oils.

Tropical Life November, 1931.

MALAYAN AGRICULTURE AT UNITED KINGDOM EXHIBITIONS, 1931.

The following abstracts from reports recently received indicate the valuable work performed by the Malayan Information Agency in giving publicity in the United Kingdom to the agricultural products of Malaya.

The Imperial Fruit Show, 1931.

This year the Imperial Fruit Show was held at the City Hall, Manchester, from October 30th to November 7th, and attracted large crowds each day.

The Malaya stand, as in previous years, was in the Empire Marketing Board section. The space was devoted to demonstrating Malayan canned pineapples.

Apart from the interest shown in the stand by the general public, a very satisfactory volume of enquiry for pineapple came from grocers of Lancashire and Cheshire and many of these were put into direct touch with the importers.

The cookery demonstrations given at the stand daily were not confined to the use of Malayan pineapple in the concoction of sweets, but were designed in even greater measure, as on previous occasions, to teach the public how savoury dishes can be improved by the addition of a little pineapple.

A special feature this year was the introduction of a few demonstrations specially intended to popularise Malayan tapioca. Talks were given from the stand, at frequent intervals, both on pineapples and tapioca.

Sample tins of pineapples and receipt-booklets were on sale to the public. Fifty cases of pineapples were sold and used for demonstration purposes, while the receipt-books met with a ready demand.

One of the most gratifying features of the Show was the large share of attention secured in the Press by the Malayan exhibits. Also, the stand received a most satisfactory amount of attention in a wireless talk on the Fruit Show, and a large number of visitors mentioned that they had been attracted there by the account of the activities of the Stand given in the wireless talk.

To sum up, it is felt that the Imperial Fruit Show of 1931 was the most successful one in which the Malayan Information Agency has hitherto participated, both from the point of view of general publicity and from that of the benefit which seems likely to accrue to the pineapple trade as its outcome.

International Grocers' Exhibition, 1931.

This exhibition was held at the Agricultural Hall, Islington, from September 19 to 25.

Malaya was represented by a small stand in the Empire Marketing Board Section, devoted to a display of Malayan canned pineapples, exhibited in the fullest possible variety of packings and labellings, the supplies being kindly provided free of charge by five firms.

A new feature this year was the 11 lb. size tin of round cut Golden quality slices in water, a packing specially put up to meet the requirements of restaurants.

A comprehensive range of samples of Malayan tapioca were also exhibited.

Probably owing to the fluctuations then taking place in Sterling, business on the opening days was not too good. Later, however, the business transacted on the stand became easily double that of last year. Whenever possible, the enquirers were persuaded to put through their orders on the spot, and in view of the anticipated tariffs it may reasonably be presumed that the majority of these orders will have matured. Some of the enquiries involved special outsize packing.

The Southend Carnival.

This festival was held from the 25th to the 29th August inclusive. The Empire Marketing Board staged an Empire display in a marquee, in which Malaya occupied a fine stand in a commanding position.

The Malaya stand was devoted chiefly to the display of Malayan canned pineapples. Sample tins were distributed to the public, accompanied by a booklet describing the production and canning of the fruit in Malaya and the booklet of 50 recipes for cookery with the aid of pineapple.

That the public was exceedingly responsive is proved by the fact that 32 cases of pineapple were disposed of, the stand exhausting its supply on several occasions.

Two cases were used for demonstration purposes to shew the quality and to allow the public to have an opportunity of testing the fruit.

Hitchin Civic and Empire Shopping Week.

Throughout the duration of this festival, an exhibition was held at the Hitchin Town Hall from September 28 to October 3.

The attendance was large and the visitors enthusiastic, the more so because the Civic Week chanced to syncronise with the abandonment of the Gold Standard and the first rush of fervour for Empire products which followed.

The Malaya stand was attractively decorated. The purpose of the stand was to display Malayan pineapples, of which sixteen different labellings were shewn. A comprehensive exhibit of tapioca was also staged.

Malaya's participation included two addresses in Hitchin on Malayan products, the second of which was at the Town Hall, the speech being relaid through amplifiers to the crowd outside in the streets.

Reviews.

Laboratory Experiments on the Larvicidal Properties of Mineral Oils.

BY

G. H. Corbett and E. P. Hodgson,

Bulletin No. 5 of 1931 from the Institute for Medical Research, Federated Malay States.

This publication, which should prove of interest to agricultural workers, records the results of extensive but preliminary laboratory experiments from which certain oil mixtures have been selected for field trials in the control of mosquitoes.

This investigation was commenced as a result of the attention of the Malaria Advisory Board being drawn to the desirability of preparing a standard specification for anti-malarial oils applicable throughout Malaya, whereby the less effective of the heavy oils could be eliminated and a reduction effected in the relative quantity of the more costly components, namely, solar and light oils.

The original samples included nine different oils, two heavy, one solar and six light. Five of the light oils were found to kill most rapidly, except in the case of pupae; the solar was slower in action and the heavy oils yet slower. Of the light oils, one showed a slight superiority over the other and of the heavy oils one was found to be slower in action than the other, thus indicating that oils sold under the same "trade" name may give widely divergent results.

Several experiments were performed in which larvae were tested against films that were exposed to atmospheric conditions for several days. The results demonstrate that the two heavy oils and solar oil, when left undisturbed, remained effective after a fortnight, though less rapidly than at first and that only one of the light oils showed any marked toxicity after the first day.

As a result of these preliminary investigations, experiments were conducted with mixtures which were designed to include all possible practical combinations of the best heavy and light oils and solar oil.

Subsequently, the following four mixtures were selected from these combinations.

(1). Heavy 2 parts, Solar 1 part.
(2). Heavy 12 parts, Light 1 part.
(3). Heavy 3 parts, Solar 9 parts, Light 1 part.
(4). Heavy 8 parts, Solar 4 parts, Light 1 part.

In a series of experiments, fresh films of these selected mixtures were used and 500 larvae of *A. vagus* were tested against each mixture. In other series, experiments were conducted with films of different ages and with larvae of different species of mosquitoes.

The results of all these experiments are recorded and illustrated in graphical form.

Heavy oil is considered to be the component responsible for the persistent toxicity of a mixture, although a small quantity of solar appears to assist in that direction. Of the anophelines, larvae of *A. vagus* were found to be less resistent than those of *A. maculatus* and *A. hyrcanus*; of the culicines, *Stegomyia* spp. proved much more resistant than the anophelines, while *Culex* spp. succumbed more rapidly than *A. vagus*.

A discussion concerning the results of the foregoing experiments follows in which the evolution of oiling mixtures in Malaya is reviewed. It is suggested that the reasons for the changes in the composition of oiling mixtures in Malaya would appear to be confirmed by the results of these experiments.

In addition to the above, experiments were conducted in order to test the toxicity of the vapour of the oils. The results show that the vapour, if any, from the heavy and solar oils is not toxic to larvae and that the most volatile oils seem generally to be the most rapidly toxic.

Following these experiments, the physical properties of oils in relation to their toxicity are briefly discussed.

The writers summarise the results of these laboratory experiments as follows :—

1. Experiments with oil samples and mixtures prepared from them have resulted in the selection of mixtures for field trials.

2. The larvicidal properties of oils bear little relation to their commercial specification; several oils sold under the same "trade" name gave widely divergent results.

3. Whilst it is impossible at the present juncture to prepare a satisfactory specification for larvicidal oils, based on physical and chemical factors, certain properties have been demonstrated to be of primary importance. These are, viscosity, surface tension, aromatic content, and the retention of toxicity in film form. Volatility is of less importance than is generally supposed.

4. Field experiments, which are in progress, are essential before biological, physical and chemical specifications for anti-malarial oils can be prepared.

(*Contributed.*)

The Root Disease Problem on Old Rubber Areas in Malaya

BY

A. Sharples and A. R. Sanderson,

Bulletin No. 3. Rubber Research Institute of Malaya. 42 pp., 2 plates. Price $1. November 1931.

This bulletin contains new and valuable information on root diseases of rubber especially on the disease caused by *Fomes pseudoferreus* (*Ganoderma pseudoferreum*).

The writers have established that this disease is not necessarily confined to old rubber, but that it occurs also on very young rubber irrespective of any particular soil type or site. The spread of the disease is entirely by underground root contact, and analysis of total root disease cases, in large blocks of trees of different ages, showed that *F. pseudoferreus* is by far a more serious agent of destruction than *Fomes lignosus* or *Ustulina zonata*.

Attention is directed to the serious aspect of root diseases in general—and of *F. pseudoferreus* in particular—as a factor in determining the economic life of Malayan rubber plantations. A replanting scheme is outlined for estates, with areas showing declining yields, where consideration of a future policy is becoming imperative. In this connection, the probable effect of the successful establishment of high-yielding areas, by means of bud-grafting, on future planting policy is pointed out.

It is suggested that the annual writing off of a certain percentage of the planted area against disease wastage will be considered just as necessary an item in the annual budget as depreciation of machinery and buildings.

Full recommendations for treatment according to incidence of disease are given.

A. T.

Annual Reports for 1930, Technical and Field Officers of the Department of Agriculture, S.S. and F.M.S.

Special Bulletin, General Series No. 6 Technical Reports for the Year 1930, 84 pp. price 50 cents and No. 7 Reports of Agricultural Field Officers for the Year 1930, 116 pp. price 50 cents, post free.

While not attempting to give a detailed account of the research and field work of the Department, the above-mentioned reports give a complete summary of the results achieved during the year under review and of the progress of extended pieces of research work in hand. Full accounts of completed work are published from time to time in the *Malayan Agricultural Journal* or in Special Bulletins of the Department.

The technical reports are nine in number, each containing a record of a Division of the Department *viz.* Agriculture, Agricultural Instruction, Chemistry, Economics, Economic Botany, Entomology, Mycology, Soils and Plant Physiology and Statistics.

There are eleven reports of Field Officers, which embrace the activities of agricultural field research in all the States of Malaya with the exception of Kelantan and Trengganu. Appendices to this volume contain statistical information concerning such subjects as plant importation, plant distribution, land alienation and court cases.

Miscellaneous Articles.

REPORT ON SEGAMAT SAWAH COMPETITION, 1931

BY

G. HAWKINS,

Assistant Adviser, Segamat.

Introduction.

It is stated that Segamat formerly produced much rice and fruit. The rubber boom involved the neglect of other agricultural products and continued so long that the younger generation has never acquired the technique of padi-planting. The rubber slump left the Malays bewildered and their attempts at planting padi were so laborious and unskilful that they are yet to be persuaded that rice and fruits are profitable crops, their own experience being that much labour yields little result. Increasing economic pressure compelled attention to the supply of food and it was considered advisable to stimulate interest by a competition on new lines. The competition was not an agricultural show which encourages the concienceless collector rather than the real planter but a contest for the best tilled *sawah.*

Prizes.

The generosity of the General Adviser, Johore, and the Executive Engineer, Segamat, made it possible for attractive cash prizes to be offered. There were three first prizes of $25 each and three second prizes of $15 each and a prize for the *Penghulu* or Naib*§ who was most assiduous in encouraging his *anak buah*† to plant. In addition, a certificate was also given to each winner. Thanks to the great assistance of the District Officer, the *penghulus* were circularised early in July and the District Officer transmitted the names of 412 contestants.

Judging.

Judging was done in November, in accordance with a previously notified programme, by the Assistant Adviser in consultation with the Chief Settlement Officer, Che Puntong and the Padi Officer, Che Ahmad. Contestants were told that judging was not from the point of view of yield but of method of planting, i.e. marks were given for uniformity of planting, water control, preparation of divisions and *batas*‡ etc. as shown in the Barnes' card. A few copies of the Barnes ¶ card were handed out. The Padi Officer took the opportunity of distributing pamphlets about rats. Judging next year should be in October so as to shift the whole planting programme slightly forward.

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* Penghulu=Local Headman. § Naib=Deputy. † Anak buah=People under *Penghulu.*
‡ Batas = bunds. ¶ A copy of this card is published on page 80 of this issue.

Results.

Tenang was easily the best area. The constant encouragement given to planters by Mr. C. Bradbery of North Labis was of the greatest value. The *Penghulu* and his *Naibs* did excellent work and the *sawah** of themselves and of their *anak buah* are comparable to those in the Negri Sembilan where padi planting is regularly carried on. It is said that the Tenang Malays emigrated from Malacca and have planted padi for 100 years. So long as rivers are kept clear and clean, there is no reason why padi should not be planted for another 100 years. No one complained of pests, and in most cases, rat traps, ducks and clearing of adjacent land were manifest.

The most popular variety was Serendah. Planting was late and an early flood may be disastrous. No one had considered the digging of *Kolam*§ where the variety of edible fish known as Sepat Siam could be introduced, but a few thought the experiment could be tried. There was unworked *sawah* land that could be utilised. If *kampong*† land is kept for, and settled by, genuine padi planters, these areas could be again brought under rice. The cause of this neglect is due to shortage of population. Some of the *sawah* is very inaccessible and to reach one area took a 4 hours' walk.

Jementah was uneven. The Legeh valley was very good, but the Jementah valley showed patchiness in area and spasms in the cultivation. It is a long, rich, narrow valley and should yield abundantly, but islands of *blukar*,‡ and haphazard methods lead to attacks of pests which are almost uncontrolled. Much ingenuity had been shown; one Malay had a *kenchir*,* another an ingenious water-course through a tree trunk. A Bengali, several Chinese, Maalafs and Javanese were planting. The *Penghulu* and the *Naibs* are working well, and under present economic conditions, will make a great improvement in 1932.

Pogoh has made a promising start and should improve. A drain constructed by the Public Works Department was very cleverly used as a *tali ayer*.*

Jabi was patchy and should improve.

Tebing Tinggi after Jementah and Tenang is the most promising area. A Rembau woman and the *Naib* himself set an excellent example in a newly opened *sawah* capable of ten-fold expansion with good *kampong* land available nearby. The *Naib* is doing very good work and is getting an increasing number of people to concentrate on one large area rather than the opening up of small areas.

Gemas was the worst *mukim* and the small holdings gave full and depressing evidence of apathy and neglect. The *sawah* were few in number, small in area and widely separated. The bad cultivation and subsequent poverty of Gemas may be due to the following reasons :—

(a) the soil is poor;

(b) floods that may last for 14 days are an annual occurrence;

* Sawah = wet padi land. § Kolam = pond.

† Kampong = a small holding or native homestead. ‡ Blukar = secondary jungle.

* Kenchir = water-wheel. * Tali ayer = small distributing channels for water

(c) the settlement is said to be over 200 years old and to be of Pahang origin. The people have no great agricultural skill, practise shifting cultivation, abandon their holdings during long visits to Pahang, occupy right up to the river banks and practise wasteful methods of fish catching. Numerous cases were observed of relatively large rice areas in which only a fraction was tilled and the rest abandoned. The planters of the pathetic remnant told the writer that their friends with whom they had opened up the area only a few years ago had gone off and opened up elsewhere. These fissive tendencies are fatal to an essentially colonial enterprise.

(d) Most of the people have holdings too large for proper tillage.

Whatever the causes, it will take years of constant effort to effect any improvement. As a start, it is proposed to close the land office books for this *mukim* and to call a halt to shifting cultivation.

Considerable interest was aroused and it was pleasant to be able to get into personal touch with padi planters on their own ground. Most planters were present during the judging and the opportunity was taken to impress on them the importance of adherence to a pre-arranged planting programme and of communal and continued effort. That the idea was a success could be fairly claimed. Unusually good weather made the padi in 1931 flourish; it is not unlikely that economic pressure will force still greater attention to *sawahs* in 1932, and perhaps this competition, which stressed the technique of cultivation, may be a solid benefit.

THE BARNERS' CARD. No.

SCORE CARD FOR JUDGING SAWAH.

District..... Mukim..... Kampong..... .. ..

Owner's Name..... .... E.M.R..... ..... Lot No, ...Acreage..... . .

	Marks. Very Good 5. Good 4. Very Fair 3. Fair 2. Bad 1. Very Bad 0.	MARKS.	Date and Initials of Judges
1.	**Cultivation.** Maximum marks 20.		
	a. Preparation of divisions of fields and banks of water courses, freedom from grasses and no waste of water. ...	.....	.....
	b. Preparation of Sawah, absence of growing grasses.		
	c. Absence of busut and shelter for rats. ...	.....	.....
	d. Clearing of adjacent land. ...	.....	.....
2.	**Transplanting.** Maximum marks 20.		
	a. Regularity and distance of spacing. ...	.....	.....
	b. Number of plants per hill. ...	.....	.....
	c. Freedom from grasses and weeds. ...	.....	.....
	d. Rat Control. ...	.....	.....
3.	**Growing period.** Maximum marks 20.		
	a. Regularity of growth. ...	.....	.....
	b. Freedom from grasses and weeds both in sawah and in batas. ...	.....	.....
	c. Rat Control. Adjacent land kept cleared. ...	.....	.....
	d. Maintenance of batas and tali ayer banks ...	.....	.....
4.	**Flowering period.** Maximum marks 20.		
	a. Uniformity of flowering. ...	.....	.....
	b. Purity of padi. ...	.....	.....
	c. Batas clean and well kept and adjacent land cleared. ...	.....	.....
	d. Rat Control. ...	.....	.....
5.	**Ripening period.** Maximum marks 20.		
	a. Pureness of padi. ...	.....	.....
	b. Uniformity of ripening. ...	.....	.....
	c. Freedom from empty grains. ...	.....	.....
	d. Quality of crop. ...	.....	.....
	Total marks possible 100 ...	.....	.....

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

FOURTH QUARTER 1931.

Rainfall.

In October, the rainfall generally was a little below normal. November showed a precipitation slightly above the average on the East and West coastal districts, while the inland figures were normal for the month. In December the general rainfall was above the average, particularly in the inland districts of Perak and Pahang, occasioning the flooding of the Perak and Pahang rivers: the rainfall along a strip of the Selangor—Negri Sembilan coast, however, was slightly below the average.

Prices.

The following tabulated summary indicates the prices paid to small-holders by local dealers, as compared with the average Singapore price for the month for standard sheet and price quoted in Singapore and Penang by large dealers for small holders' rubber at the end of the month.

All quotations are given in Straits dollars and cents at the price per picul (133⅓ lbs) for ease of comparison.

Table of Rubber Prices

4th Quarter 1931.

	Singapore Standard sheet Average	Singapore for small holder's rubber	Penang for small holder's rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Penang	Johore
					OCTOBER						
Smoked sheet.	11.75	12	9-12	7-11.50	9-12	7.50-12	7-12.25	7.50-12	9-10	8-13	8-12.25
Unsmoked sheet.		10	7-11	6-10	7-9.30	6.50-10	7-9	6.75-10.50	3-9	7-10.50	5-10.50
Scrap		2	5-6	3-5.50	2.50-5	2-6	3-5.50	2-6	4	3 6	2-6
					NOVEMBER						
Smoked sheet	11.68	9	9-12.25	9.40-11-40	10-11	9.50-11.20	9-12	8 12	9-10	8-12	6-10.80
Unsmoked sheet		7.50	7-10	8.50-11.15	8.50-10	7.50-10	7-9	7-10	8-9	6-10,80	5-9.75
Scrap		2	3-5	5-6.20	2-6	3-5.50	3-5.50	2-5.50	4-4.50	2.50-4	1.50-5.50
					DECEMBER						
Smoked sheet.	13.24	11.75	12.25-13.80	10 25-14	11-15	8-14 50	10-13.75	8-15	11-14	No returns received owing to floods	9-13.75
Unsmoked sheet.		10.50	9-13	9.50-11.15	8 70-12	7 13 50	7-11.75	7.75-13.50	9-13		8-12.50
Scrap		4	4-6	5-7	2-6	3-6.50	3-6.50	2-7	4-8		2-7

In comparing the above figures it must be realised that the quotation for Singapore standard sheet is the average price for the month, whereas other quotations give the range of prices during the month, and except in the case of Singapore and Penang, the range of prices over a number of buying centres. In some of these centres the price is regularly maintained at a higher level than others. For example in Perak for December the range of prices in dollars per picul for smoked sheet at the centres was as follows—

Taiping $13 to $14.50	Tapah $12.50
Krian $11.50	Kinta $11.50
Selama $10 to $13	Tanjong Malim $12
Kuala Kangsar $11 to $11.50	Bagan Datoh $11.50
Lenggong $8 to $12	Teluk Anson $12.

It will be noticed that the prices paid in several centres are higher than Singapore or Penang quotations for small-holder's rubber.

Tapping.

Report from Penang Island states that small holdings continue to go out of tapping and that many have now been abandoned. In no other case do the reports from the districts indicate any further cessation of tapping on holdings of a small area, which are either owner-tapped, or worked on a share system, other than the normal decrease of tapping in padi areas during the harvesting season.

On a number of Chinese and Chettiar owned holdings of a larger area employing hired labour, the area under tapping has been decreased, poor yielding portions being left to rest. There has been no noticeable alteration in the habitual tapping systems, fluctuations in market price do not appear to have affected the output.

The following table obtained from the bark consumption investigation figures shows the monthly average percentage of trees in tapping taken over lots of 100 consecutive trees per holding on 62 holdings over a period of 3 months.

Nationality of owner.	Average percentage of trees in tapping in each 100 trees.
Malay	... 65
Chinese	... 69
Tamil	... 68
Javanese	... 65
Sumatran	... 61

In almost every case trees are left out of tapping only on account of low yielding and not because of an insufficiency of tappable bark.

The following figures have been given by the Bark Recorder showing the systems of tapping cuts in vogue on small holdings; these figures represent the average taken from 3 consecutive monthly measurement on lots of 100 consecutive trees or a total of 62 widely distributed holdings.

Table of Tapping Systems and Lengths of Cuts.

1 Average percentage of single cuts on each holding.	2 Average Length of each single cut.	3 Average percentage of V cuts.	4 Average Length of each V cut.	5 Average percentage of 2 cuts on same panel.	6 Average Length of each cut.	7 Average percentage of cuts of different height on different panels.	8 Average No. of cuts.	9 Average Length of each cut.
		Malay owned holdings (28 Holdings)						
72	$\frac{8}{8}+\frac{3}{8}$p	14	$\frac{8}{8}$p	2	$\frac{8}{8}+\frac{1}{8}$p	12	2	$\frac{8}{8}+\frac{2}{8}$p
		Chinese owned holdings (16 Holdings)						
94	$\frac{8}{8}+\frac{2}{8}$p	2	$\frac{8}{8}+\frac{1}{8}$p	1	$\frac{5}{8}$p	3	2	$\frac{8}{8}$p
		Tamil owned holdings (8 Holdings)						
81	$\frac{8}{8}+\frac{3}{8}$p	4	$\frac{8}{8}+\frac{2}{8}$p	3	$\frac{8}{8}+\frac{2}{8}$p	12	2	$\frac{8}{8}+\frac{2}{8}$p
		Javanese owned holdings (5 Holdings)						
48	$\frac{8}{8}+\frac{2}{8}$p	51	$\frac{5}{8}$p	—	—	1	2	$\frac{8}{8}+\frac{1}{8}$p
		Sumatran owned holdings (5 Holdings)						
88	$\frac{8}{8}+\frac{4}{8}$p	—	—	5	$\frac{8}{8}+\frac{4}{8}$p	7	2	$\frac{8}{8}+\frac{3}{8}$p

For the purpose of recording, the circumference of each tree is divided into 4 equal panels, each of which is in turn divided into 8 equal parts, thus in the above examples 8/8p is equivalent to ¼ of the circumference of the tree and 8/8p plus 2/8p signifies that the cut runs through a full panel and ¼ of the adjacent panel, i.e. approximately 1/3 of the total circumference.

Bark Consumption.—The following figures have been compiled from results obtained from the bark consumption investigations over a period of 3 months on 62 holdings.

The average monthly bark consumption per tree, is expressed in vertical inches on a panel which is one quarter of the circumference of the tree in width.

Column A = figures taken on actual number of trees in tapping only.

Column B = bark consumption shown on 100 trees, including untapped trees.

Malay.		Chinese.		Tamil.		Javanese.		Sumatran.	
A	B	A	B	A	B	A	B	A	B
$3\frac{2}{8}$ in.	$2\frac{1}{8}$ in.	$2\frac{5}{8}$ in.	$1\frac{6}{8}$ in.	$3\frac{2}{8}$ in.	$2\frac{2}{8}$ in.	$2\frac{5}{8}$ in.	$1\frac{1}{8}$ in.	$3\frac{2}{8}$ in.	2 in.

Total average consumed on trees in tapping over all holdings = 3 inches.

Average number of days on which tapping is carried out at present = 18 days.

The following are the maximum and minimum monthly bark consumption in inches on the above holdings.

	Malay.		Chinese.		Tamil.		Javanese.		Sumatran.	
	A	B	A	B	A	B	A	B	A	B
Maximum	8⅝in.	4⅜in.	4⅞in.	3⅜in.	4⅝in.	3⅛in.	3⅝in.	2⅞in.	5⅝in.	4in.
Minimum	1⅛in.	⅝in.	1¼in.	⅝in.	2⅞in.	1⅝in.	⅝in.	⅜in.	2⅝in.	1⅜in.

Minimum consumption in most cases is due rather to a limited number of tapping days per month than to care in the actual operation of tapping.

The distribution of nationality of owners of these 62 small holdings is as follows :—

Malay	...	28 holdings i.e. 45 per cent. of total number.
Chinese	...	16 holdings i.e. 26 per cent. of total number.
Tamil	...	8 holdings i.e. 13 per cent. of total number.
Javanese	...	5 holdings i.e. 8 per cent. of total number.
Sumatran	...	5 holdings i.e. 8 per cent. of total number.

Ratio of Excision to Renewal.—No reliable data are yet available on this subject; a system of measurement of bark renewal is in practice in connection with the bark consumption investigations, but no figure can be supplied until after a lapse of 12 months from the date of first measurements of depths taken on newly tapped bark.

Postponement or Acceleration of Bringing Young Rubber into Tapping.—In only one case has any tapping of immature trees been reported, that is in a Banjarese Settlement in the Dindings, where poverty is acute. Throughout the rest of the country the position with regard to acceleration or postponement of tapping of young rubber has not altered during the quarter.

Incidence of Disease and Soil Erosion.

Root Diseases.—General observations still incline to the opinion that root diseases are far less common on small holdings than on estates.

The Bark Recorder reports that from an above-soil examination of lots of 100 consecutive trees on 36 widely distributed holdings, only 22 cases of root diseases out of the total 3600 trees inspected were found as follows :—
12 cases *Ustulina zonata,* 10 cases *Ganoderma pseudoferreum*; making an average incidence of 0.6 per cent.

Mouldy Rot.—Apart from the seasonal increase of infection due to wet weather, the position with regard to mouldy rot remains unchanged since the last quarter's report.

Erosion.—This would not appear to be a very vital problem on small holdings; close planting, in some instances the planting of catch crops under young rubber, and the general practice of allowing the growth of weed, are all factors which minimise the loss of soil by erosion.

Budgrafting.

This is practically non-existent on small holdings. A few visits were, however, paid to the Rubber Research Institute's Experimental Station by Chinese for a demonstration of the standard procedure.

Grades of Rubber made.

There has been no noteworthy alteration in marketing methods since the report for the 3rd quarter, July—September. Small-holders in most districts continue to favour the sale of uncured rubber, more especially Malays who frequently sell rubber in a wet state, i.e. after hanging for not more than 24 hours, a practice which indicates an urgent need for ready cash. It cannot be said, however, that this habit has become very noticeably more common than during the preceding quarter. The preparation of "slab" rubber on a large scale is still principally confined to the Krian-Matang and Larut Districts of Perak, although there is a tendency in the Kuala Langat District of Selangor to increase the production of lump or "slab" rubber in preference to sheet. The range of prices per picul obtained for this form of rubber was $5 in October, $4.50 to $6 in November and $5 to $6.50 in December.

The following table shows the relative percentage of the sale of smoked, unsmoked sheet "slab" and scrap, in districts where records have been made.

District.		Percentage of smoked sheet.	Percentage of unsmoked sheet.	Percentage of slab.	Percentage of scrap.
Krian	...	25	50	25	
Selama	...	70	20		10
Batu Kawan	...	No sale	74	26	
Bukit Gantang	...	No sale	53	28	19
Kuala Kangsar	...	30	45		25
Tapah	...	28	72		
Kuala Selangor	...	100	No sale	No sale	No sale
Klang	...	90	No sale	No sale	10
Kuala Langat	...	80	10	10	
Ulu Langat	...	72	12		16

Tendency to abandon Rubber Cultivation for alternatives.

The increasing activity displayed in the planting of food crops on rubber holding appears to be merely subsidiary, although in Kuala Lumpur and Ulu Langat Districts of Selangor a few small areas of poor-yielding rubber amounting to an approximate total of 20 acres, have been cut down and food crops have been planted instead.

New Planting.

No newly planted areas have been reported during this quarter.

Planting Distances.

Figures received in connection with the bark consumption investigations show the following average planting distances taken from observations on 36 widely distributed holdings together with the approximate average age.

Nationality of owner.	No. of holding observed.	Average planting distance.	Maximum.	Minimum.	Average age of
		feet.	feet.	feet.	trees.
Malay ...	15	13 x 13½	18 x 18	8 x 10	16 years
Chinese ...	9	16 x 16	20 x 20	12 x 12	18 years
Tamil ...	3	16 x 16	18 x 18	12 x 12	14 years
Javanese ...	4	13 x 13½	15 x 15	12 x 12	15 years
Sumatran ...	5	14 x 13½	15 x 15	15 x 15	15 years

The Agricultural Field Officer, Penang and Province Wellesley has furnished figures of average planting distances taken on 453 holdings on Penang Island, Province Wellesley and the Dindings. The minimum planting distance recorded is on a holding on Penang Island which is at 7 feet x 8 feet. There are only 9 holdings on which the planting distance is less than 10 feet x 10 feet: the maximum distance is 21 feet x 21 feet and only 12 holdings show a distance of 18 feet x 18 feet and over. There are two interesting cases of "avenue" planting recorded, on one of which the planting distance is 14 feet x 25 feet and on the other 16 feet x 23 feet; the approximate average distance overall is 13 feet x 14 feet.

Departmental.

FROM THE DISTRICTS.

The Weather.

The dry weather commenced somewhat earlier than usual, the first three weeks of the month being generally hot and dry, except in Kedah where the wet season continued until about the middle of the month. There were occasional strong North Easterly breezes in Selangor and Negri Sembilan; high winds were also experienced in several other parts of the country. During the last week of the month there were frequent showers in the central portion of the Peninsula.

Remarks on Crops.

Rubber.—Price quotations for small-holder's rubber have decreased slightly from those which prevailed during December, ranging in dollars per picul from 8—14 for smoked sheet, from 7—12.50 for unsmoked sheet and from 2—7 for scrap: the price for "slab" rubber in Nothern Perak was from 5—6 dollars per picul. For comparison it may be stated that the range of prices in Penang for small-holder's rubber was from 11.20—13 for smoked sheet and from 8—9.60 for unsmoked sheet.

Dry weather during the month caused wintering to commence generally in most parts of the country. In Province Wellesley and Negri Sembilan, a number of small-holdings were left untapped while their owners were occupied with the padi harvest, this cause increased the untapped area in Negri Sembilan by 1200 acres, to a total of 8200 acres. Wintering was also responsible for the cessation of tapping on a number of other properties, more especially on those owned by Chettiars. On the other hand, low yields due to wintering caused severe tapping in the Dindings and tapping by torchlight at 3 a.m. on Penang Island. In Singapore island tapping was recommenced on a number of holdings owing to the approach of the Chinese New Year.

Except in parts of Perak South and Selangor, where it was still troublesome, there was a considerable decrease in the prevalence of Mouldy Rot disease, caused by the drier weather.

Padi.—The padi harvest was completed in Selangor and was nearing completion in Negri Sembilan and Malacca. In all other areas it had been commenced, though the state of development of the crop varied considerably. On the whole, the harvest is earlier this season than it has been for several years. Crop prospects are good in Kedah and Malacca and in other centres better yields are being obtained than those of last year, except in Province Wellesley Central and South, Penang Island and the Dindings, where draught and pests have caused considerable damage. It is noteworhy that unusually high winds have caused "lodging" of the ripening crop in several localities. It is remarkable that in the mukims along the Perak river the padi, which was under water for a week, was not severely damaged by the floods unless it was already in flower or growing

in places where the subsiding water collected and remained stagnant. No reports have yet been received from Pahang. In Kedah and in Krian difficulty has been experienced in obtaining assistant labour to reap the crop. There has been a slight rise in the price of padi, which in Kedah, the Province and Krian, has ranged between 6 and 8 cents a gantang. Elsewhere prices have ranged from 8 to as much as 20 cents a gantang.

Tobacco.—There has been an extension of the area planted with this crop in Perak South and Selangor. In the latter State a Jaffna type appears suitable for planting on the peaty soils of Kuala Langat District. In the Settlement of Penang 96 piculs of cured leaf have been sold, the prices varying from $10 to $30 per picul; elsewhere the prices have ranged from $30 to $40 for cured leaf. In Perak South it is reported that the locally grown product is coming into competition with Siamese tobacco imported by the Chinese shopkeepers.

Fruit.—A good "off-season" crop of fruit, such as durian and mangosteen, was harvested in Province Wellesley and the Kuala Langat District of Selangor: the crop was also coming into the market in Perak North and the remaining Districts of Selangor. In Negri Sembilan, however, fruit had not yet appeared on the market, while in Singapore the crop was reported to be poor.

Foodstuffs and Vegetables.—It was observed that Malays in Penang Island were growing vegetables somewhat extensively on the bunds of padi fields. In the mukims along the Perak river vegetable gardens were washed away by floods, but maize is now being planted on the islands in the river and along the banks. In Malacca an increased tendency to plant food crops has been observed, although the increase in the amount produced is not yet very great. Some Chinese owners of padi land near the town are planting vegetables on their land during the "off-season".

Cover Crops.—A native cover-crop, identified as *Marremia* (Ipomoea) *vitifolia* is thriving well and proving useful under young rubber on an estate in Kedah: it has the advantage of not being damaged by the giant snail, which is abundant on the property.

Live Stock.—The export of live stock from Kedah increased considerably, owing in no small part to adverse rates of monetary exchange with Siam; as the State was overstocked this revival of the export trade was welcome.

Rat Control in Padi Fields.—Little or no damage caused by rats has occurred in Province Wellesley or Krian during the month. In Penang Island, however, where the work has recently been organized, severe damage occurred in some localities. Giant snails have been used as bait, a hole being drilled in the shell and sodium arsenite inserted; they are reported to be as effective for this purpose as dead grass hoppers.

Agricultural Stations and Padi Test Plots.

KEDAH. *Telok Chengai Rice Station and Padi Test Stations.*—The padi at the Rice Station matured under favourable weather conditions. Field characters

of pure lines of local varieties were checked and preliminary selections made. Rain and wind caused certain varieties to lodge, notably Siam 29 and Nachin 10, which also lodged at all the Test Plots where they were grown. At all the Stations observations were made on the incidence of stem-borers which were numerous at the Telok Chengai Rice Station and on Jitra Test Station although, as the attack occurred late in the season, the resulting damage was not serious.

Province Wellesley. *Glugor Padi Test Station.*—Much time was given to rat control, more especially by pumping calcium cyanide powder into rat holes in bunds, with satisfactory results. Damage by stem-borers was observed. Several of the padi strains flowered.

Bukit Merah Padi Test Station.—This Station was maintained in good condition, giving promise of a good crop. Several strains were commencing to ripen. Some of the plots of Siam 29 and Nachin 10 lodged owing to the weight of grain produced.

Perak. (a) *Agricultural Stations. Selama.*—Further planting carried out during the month included pineapples, pepper, tapioca, groundnuts, Robusta and Liberian coffee and tea seedlings. Dry weather experienced after planting will render much supplying necessary when conditions again become favourable.

Kuala Kangsar.—Stumps of tea were planted out; work on the sireh garden was commenced. Other plantings included a plot of Rangoon tobacco, avocado pear and orange seedlings in nurseries and orange marcots in beds ready for sale.

(b) *Padi Stations and Test Plots. Talang.*—All strains of padi were flowering and had apparently suffered but little damage in the December flood.

Lenggong.—Harvest was about to commence at this Station where the Seraup strains were ripening. On several plots the Seraups lodged owing to wind and rain, but the Radin strains stood well.

Bruas.—The local Radin strain was being harvested, but ripening was uneven; Radin No. 7 was backward, having not yet reached the flowering stage, and showed poor growth. The Seraup strains, which had grown well, lodged owing to wind and rain.

Bukit Gantang.—Flowering was practically complete on the lower areas, but the padi was backward on high land where water difficulties have been experienced throughout the season. Rats continued to give trouble.

Kamunting.—The padi on this Plot was approaching maturity. Birds did appreciable damage in spite of efforts to protect the crop. Liberations of stem borer parasites were continued.

Selinsing.—The ripening crop presented a very promising appearance, having sustained no further damage from pests. During the month a well attended and successful demonstration to head-men was organised; the visitors were particularly impressed by the superiority of the crop on the cultivated plots.

Selangor. *Cheras Agricultural Station.*—The entrance gates, a temporary store and a manure shed were erected. Work was commenced on the preparation of the market garden area for planting and the market gardener's house was nearly finished. Coffee, tea, a number of local fruits trees, avocado pear, bananas,

pineapples, sugar cane, tuba root, tobacco and Guinea grass were planted.

Kajang Test Plot.—The padi harvest was completed, the yields recorded in gantangs per acre being, Nachin 27—320, Radin 2—120, Radin 13—265, while the average yield in the adjoining fields was 200. The low yields from the two Radin strains were due to damage by pests and birds and to unsatisfactory growing conditions.

Kuang Test Plot.—The harvest was completed during the month. Yields in gantangs per acre were, Radin 4—152, Seraup 48—161, Seraup 36—189, Nachin 27—221, Radin Siak—223, local padi—243, Radin 2—251, Radin 13—253, Nachin 10—334, Siam 29—441. The three late maturing varieties of padi first mentioned gave low yields owing to the depredations of birds and to heavy stem-borer attacks in the early part of the season. Nachin 27 and Radin Siak, being the first strains to ripen, suffered from the attacks of padi fly (*Leptocorisa* sp.) and birds.

Negri Sembilan. *Seremban Agricultural Station.*—A further area of yams was harvested and a good crop of Salisbury White maize was reaped.

Rembau Agricultural Station.—Marcots of chicku and rambutan, further cuttings of pepper and a plot of Bambarra ground-nuts were planted. *Crotalaria usaramoensis* was sown where low cover crops had not grown well.

Rembau Padi Test Plot.—Two plots received dressings of ammonium sulphate at the rate of 100 lbs. per acre. A plot of F. 756 was harvested and the one-hundred-day padi was transplanted and started well.

Malacca. *Sungei Udang Agricultural Station.*—Work was commenced on clean clearing the padi and root-crop areas. Banana suckers and pulasan marcots were planted. The buildings were nearing completion.

Pulau Gadong Padi Station.—Harvesting proceeded throughout the month and was practically completed at its close.

Alor Gajah Test Plot.—Harvesting was completed.

Singapore. *Pineapple Experiment Station.*—The Acting Chief Agricultural Field Officer visited the Station on the 17th January to consider the revision of the manurial programme rendered necessary by the backward condition of the pineapple plants owing to the depleted soil.

DEPARTMENTAL NOTES.

Return to Duty of the Director of Agriculture.

Dr. H. A. Tempany, Director of Agriculture, S.S. and F.M.S., returned from leave of absence on 4th February, 1932.

School of Agriculture, Malaya.

The next school year at the School of Agriculture at Serdang will begin on or about 17th May, 1932. It is of interest to record that one private student from Sarawak has already been enrolled for the next three years' course and that places have been reserved in the school for one three years' student from British North Borneo and for two Pupils for the one year course from Brunei at the request of the respective Governments.

The interest taken in the school from abroad is encouraging.

Pigs at Serdang Stock Farm.

The stock farm at the Government Experimental Plantation, Serdang includes a total of 48 pigs. The health of the stock is good.

The carcase of a pigling suspected to be infected with worms was sent to the Veterinary Surgeon, Kuala Lumpur, for examination. The report stated that no parasites were discernible and the carcase was free from tuberculosis diseases. The heart, kidneys, spleen and digestive organs were normal, healthy and sound. There was, however, a pronounced cirrhosis of the liver. The Government Veterinary Surgeon added that these findings would tend to indicate the presence of irritant substances in the food. The lesion may, however, have been caused by frequent irritant medicines.

The Senior Agriculturist states that this particular young pig had not had any vermifuge or other medicines. It was about 3 months old. This individual out of 20 (two litters) was very emaciated and any irritant in the food would be expected to some extent to effect all the piglets.

There is the possibility that this pig, being weaker than the rest, was pushed away from the concentrated foods given, and relied for its maintenance on the grass that is fed daily.

In this connection, it is interesting to record that the Chemical Division has found traces of prussic acid in very young guinea grass (*Panicum maximum*). This might account for the irritant suggested in the report.

A few such cases occur in each litter and their condition has been attributed to internal parasites. Improvement has been observed in some pigs in the past after a dose of Santonin.

It is stated that the emaciation of one or two pigs per litter is fairly common throughout the country, the cause generally having been attributed to internal parasites.

Groundnut Cultivation in Malaya.

A firm of oil millers in Malaya has recently written to the Department to enquire whether groundnuts are grown in British Malaya, as the firm wishes if possible, to purchase local groundnuts for their mill.

This letter indicates that there is at hand a certain local market for groundnuts. The present annual net import of groundnuts is about 8,000 tons, valued at approximately one million dollars. In addition, about 13,000 tons of the oil are imported for local consumption, so that the net imports of nuts and oil is valued at about $5,000,000 at present prices.

Planters who have groundnuts for disposal in quantity are invited to write to the Department, when they will be placed to touch with probable purchasers. (Ref. D.A. 131/32).

Appointments.

Mr. G. D. P. Olds, B.Sc., Agricultural Field Officer, S.S., arrived from England and reported for duty on the 7th. January.

Mr. J. A. Baker, B.Sc., A.R.C.S., Agricultural Field Officer, F.M.S., arrived from England and reported for duty on the 7th. January. He was seconded for duty in Johore on the 25th. January.

Leave.

Mr. J. Lambourne, Assistant Agriculturist, returned from leave of absence on 7th January, 1932.

Mr. J. H. Dennett, Assistant Chemist, returned from leave of absence on 21st January, 1932.

Mr. N. C. E. Miller, Assistant Entomologist, returned from leave of absence on 22nd January, 1932.

Statistical.

MARKET PRICES.

January, 1932.

Markets during the month have been dull and dragging, the volume of business passing in most articles being small owing to absence of demand from consuming markets.

Rubber.—The average buyers spot price in Singapore for rubber smoked sheet equal to London standard was 9.43 cents per lb., the average London price for the month being 3.05d. and New York Gold cents 4.49 per lb.

Palm Oil.—At the end of last year, £21 per ton was quoted C.I.F. Liverpool on a basis of 18 per cent. F.F.A. This price was maintained until the last week of January, when the price fell by 10 shillings. For the most part, the market has been reported steady, but ends quiet.

Copra.—Prices for January shew some improvement over the previous month. Sundried averaged $5.73 per picul in Singapore, and Mixed $5.20 per picul, as compared with $5.71 and $5.09 respectively for December, 1931. Copra cake was quoted at $2.20 per picul throughout the month.

Coconut Oil.—The average wholesale export price in Singapore for coconut oil for the month of January was $10 per picul. Business was rather dull and the increase of price was in sympathy with the increase in copra prices.

Gambier.—The market has declined for all grades during the month. Block gambier was quoted nominally at $15 per picul at the beginning of the month and closed at $13.20 the average price for January being $14.30, as compared with $13.20 for December, 1931. Cube No. 1 has declined from $24 to $21 per picul. The average price for January was $22.40 per picul as compared with $23 in December.

Rice.—The average declared trade value of rice, all sorts, per picul for 1931 was $4.17, as compared with $6.52, $7.23 and $7.06 in 1930, 1929 and 1928 respectively.

The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in December, 1931 was $4.43, as compared with $4.21 in November, 1931.

The retail market prices in cents per gantang of No. 2 Siam rice during December were Singapore 32, Penang 36 and Malacca 26.

Arecanuts.—Palambangs have dropped from $4.15 to $3.60 per picul, the average price for January being $3.88 as against $4.22 for December. Bila Whole has declined by 40 cents, the average price for the month being $3.97 as compared with an average of $4.30 in December. For other grades, the average prices in January were Split, $4.65 to $6.15; Sliced, $9.15 to $13.10; Red Whole, $7.55 to $8.75—all per picul, the price within each range depending upon quality. There are at present no stocks of Kelantan Splits.

Coffee.—There has been no demand for coffee. Average quotation in

January for Palambang coffee was $17.75 as compared with the previous month's average of $15.62 per picul. Java Robusta averaged from $23.80 to $24.80, the price within these limits depending upon quality.

Pineapples.—Quotations are easier. The London market is listless, but sellers are still disinclined to meet the sagging prices. The following are the average prices per case for January :—1½ lb. cubes, $3.92; 1½ lb. sliced flat, $3.80; 1½ lb. sliced tall, $3.69 nominal as compared with $3.90; $3.50½ and $3.61 respectively for December.

Tapioca.—Prices shew a slight downward movement. Average prices per picul in January were :—Flake, fair, $3.20; Pearl, seed, $4.45; Pearl, medium, $4.70. Corresponding prices in December were :—$3.33, $4.50 and $4.75.

Sago.—Dealers pressing sales on account of the approach of Chinese New Year caused a break in prices. Some recovery is recorded due to the demand from Japan and India. The following are the average prices for January :—Pearl, small, fair, $4.42,, Flour, Sarawak, fair $2.72 per picul as compared with $4.85 and $3.20 for the previous month.

Nutmegs.—A neglected market. Average prices for January were :—110's, $27.30 per picul; 80's, $30.40 per picul.

Mace.—No business and general decline in prices. Siouw averaged $57.40 and Amboina $47.80 per picul in January.

Pepper.—Market without interest. Average prices per picul for January were :—Singapore Black $23.50; Singapore White $30.70, Muntok, White, $31.70, as compared with $23.80, $32.20 and $33.20 in December.

Cloves.—Prices for cloves have been nominal and unchanged throughout January at Zanzibar $48 and Amboina $50 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co. Ltd, Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs.

The Dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.*

December, 1931.

Malaya.—Gross foreign imports of rice (including rice for re-export) during December, 1931, amounted to 53,377 tons, as compared with 83,560 tons for the same month last year. Of these imports, 46 per cent. were from Siam, 52.2 per cent. from Burma, 0.3 per cent. from French Indo-China and 1.5 per cent. from other countries.

Gross foreign imports of rice for the year 1931 were 691,110 tons, as compared with 800,444 tons in 1930, a fall of 13.7 per cent. Net imports were 516,832 tons as compared with 593,847 tons in 1930, a decrease of 13 per cent.

The total foreign exports of rice in December, 1931, were 17,515 tons, including 84 tons domestic production exported from Penang. Total foreign exports for the year were 174,278 tons as compared with 206,597 tons in 1930.

The padi reports indicate that work for the new season 1931—32 is in hand in all areas. In Perlis, five months' padi has already been cut and the main harvest will be in January—February.

For the season 1930—31 the total area of padi in Malaya was 708,000 acres, and production 260,000 tons of clean rice. This compares with 657,000 acres and 154,000 tons of rice for the season 1929—30.

India.—Total foreign exports of milled rice during January to October, 1931, were 1,806,000 tons, a decrease of 562,000 tons or 23.7 per cent. as compared with the corresponding period of 1930, and a decrease of 214,833 tons (10.6 per cent.) as compared with the average of the corresponding period for the past six years.

The Third Forecast of the Rice Crop in Burma for the season 1931—32 gives the area likely to mature as 12,090,300 acres, being 507,700 acres or 4 per cent. less than the final figures of last year.

The estimated outturn (states the Forecast) is 6,648,000 tons of padi which is 979,000 tons, or 12.8 per cent. less than the corresponding estimate of the previous season. The year's exportable surplus is estimated at 3,919,000 tons of rice and rice-products.

The following is an extract from Reuters' New Service dated 19.1.32. "London 18.1.32: The Government of Burma reports that the exportable surplus of rice is likely to be considerably less than was expected owing to the failure of late rains."

Siam.—Deliveries of padi at the Bangkok Mills for the year ending November 30, 1931, were 958,812 tons (approx.) an increase of 11.6 per cent. as com-

* The following is an abstract of the General Rice Summary for December, 1931, compiled from various sources by the Registrar-General of Statistics, S.S. and F.M.S.

pared with 1929—30, and a decrease of 18.8 per cent. as compared with the average of the past five years.

Exports of rice from Bangkok for the same period were 1,185,616 tons, an increase of 15.6 per cent. as compared with 1929—30, and a decrease of 10.9 per cent. as compared with the average of the previous five years.

According to the First Forecast of the 1931 Rice Crop (Principal Trade Commissioner, Ministry of Commerce and Communications, Bangkok) the area planted in the Seven Inner Circles at the end of November amounted to 4,480,000 acres, being 140,000 acres (3 per cent.) less than the final figures of 1930. The area damaged is estimated at 880,000 acres. The yield is estimated at 2,140,000 tons of padi and after deducting an amount of 1,200,000 tons for consumption and seed purposes, and adding 300,000 tons carried over from last season's crop, the surplus available for export during the present season from the Seven Inner Circles is approximately 1,240,000 tons of padi, or 930,000 tons of rice.

In the Northern and North-Eastern Circles, it is reported that there will be little surplus available for export during the coming season. It is expected, however, that the crop will be sufficient to enable them to provide for their own needs.

In the Southern Circles, it is estimated that there will be a small deficit which it is expected will be met as usual by imports from Burma.

Netherlands East Indies.—According to *Korte Berichten,* at the end of November, 1931, the area harvested amounted to 8,472,705 acres, a decrease of 140,868 (1.6 per cent.) as compared with 1930; the area damaged to 419,226 acres, an increase of 191,241 acres (83.9 per cent.) as compared with 1930; and the area standing to 1,817,319 acres, an increase of 129,700 acres (7.7 per cent.) as compared with the previous year; a total of 10,709,250 acres of rice-lands as compared with 10,529,177 acres last year, an increase of 1.7 per cent.

Java and Madura. *Korte Berichten* of December 24, 1931 states that the area of wet padi harvested in Java and Madura during the first eleven months of 1931 was 140,868 acres less than for the same period of 1930 and 194,250 acres more than the average of the same period for the years 1921/30. The area of dry padi harvested during the first eleven months of 1931 was 99,750 acres more than the average during the years 1921/30.

No statistics of area planted or harvested in the Outer Provinces are available.

French Indo-China.—Entries of padi at the port of Cholon for the year ending December 31, 1931, were 1,098,904 metric tons, a decrease of 59,800 tons or 5.2 per cent. as compared with 1930.

Exports of rice from Saigon for 1931 were 961,206 metric tons, a decrease of 97,205, or 9.2 per cent. as compared with 1930.

Information has been requested regarding prospects of the current season.

Ceylon.—Imports for 11 months ending November 30, 1931, were 399,538 tons, a decrease of 16,637 tons, or 3.9 per cent. as compared with 1930, and

a decrease of 51,079 tons, or 12.2 per cent. as compared with the average of the past five years.

Of the total imports in 1931, 16.5 per cent. were from British India, 74.3 per cent. from Burma, 0.3 per cent. from the Straits Settlements and 8.9 per cent. from other countries.

Europe.—To Europe, period January 1 to December 17, 1931, the shipments of rice from the East were 1,040,986 tons, as compared with 691,429 tons in 1930, or an increase of 50.5 per cent.

Of the total 1931 shipments, 57 per cent. were from Rangoon, 7 per cent. from Japan, 28.2 per cent. from Saigon, 5.5 per cent. from Siam, and 2.3 per cent. from Bengal.

To the Levant, period January 1 to November 13, 1931, the shipments of rice from the East amounted to 64,870 tons, an increase of 44,525 tons or 218.8 per cent. as compared with 1930.

During the period January 1 to November 12, 1931, the West Indies and America imported 145,999 tons of rice from the East, a decrease of 49,321 tons, or 25.3 per cent. as compared with the same period of 1930.

MALAYAN AGRICULTURAL EXPORTS, NOVEMBER, 1931.

Product	Net Exports in Tons				
	1930	Jan. 1—Oct. 31st 1930	Jan. 1—Oct. 31st 1931	November 1930	November 1931
Coconuts, fresh ...	10,475	9,054	7,093	672	1,416
Copra ...	102,014	81,818	79,580	13,168	11,419
Coconut Oil ...	9,475	8,005	8,129	702	906
Palm Oil ...	3,211	2,598	3,465	333	460
Palm kernels ...	485	405	554	36	90
Pineapples, canned	57,689	48,731	49,127	3,875	3,160
Tapioca ...	31,195	26,441	23,974	2,519	1,704
Arecanuts ...	23,254	20,089	16,086	1,249	1,440
Tuba root ...	55½	—	53	3*	15

* Excess of imports over exports.

ACREAGES "OUT OF TAPPING" FOR THE MONTH OF DECEMBER, 1931.

(Estates of 100 Acres and over in F.M.S. and S.S.)

Territory	Tappable Area out of Tapping		Total area Untapped*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
	Acres.	Acres.	Acres.
Perak ...	8,256	27,126	35,382
Selangor ...	11,798	37,440	49,238
Negri Sembilan ...	14,903	20,958	35,861
Pahang ...	7,105	4,000	11,105
Total F.M.S. ...	42,062	89,524	131,586
Province Wellesley ...	3,283	8,247	11,530
Dindings ...	217	1,658	1,875
Malacca ...	4,760	16,264	21,024
Penang ...	747	115	862
Singapore ...	10,247	5,735	15,982
Total S.S. ...	19,254	32,019	51,273
Grand Total ...	61,316	121,543	182,859

* Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. and S.S. during December (not included in the above figures) were :—F.M.S. 42,883 acres, S.S. 13,146 acres, Total 56,029 acres.

PRODUCTIVE RUBBER UNTAPPED IN THE UNFEDERATED MALAY STATES, DECEMBER, 1931.

State	Productive Area Untapped (Acres)		Total area untapped (Acres)
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
Johore ...	20,389	45,146	65,535
Kedah (a) ...	11,175	15,706	26,881
Kelantan ...	8,691	2,208	10,899
Trengganu (b) ...	Nil	Nil	Nil
Perlis ...	308	156	464
Total U.M.S. ...	40,563	63,216	103,779

(a) Registered companies only and are rendered quarterly, commencing with end June, 1931.

(b) Registered companies only.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF DECEMBER, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
				during the month	during the year 1931	during the month	during the year 1931	during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over					Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	14,251	12,952	12,327	141,457	9,197	105,378	Nil	Nil	Nil	26	9,884	8,592	157,464	86,685	...	18,000	12,226
Johore	...	2,392	3,854	3,782	43,417	4,940	46,332	Nil	10	Nil	42	1,015	8,104	10,061	80,717	...	2,446	3,413
Kedah	...	514	2,464	2,533	26,374	1,706	13,474	Nil	Nil	Nil	Ni	799	3,811	7,612	32,678	...	448	2,159
Perlis	...	28	7	7	79	10	130	Nil	Nil	Nil	Nil	Nil	18	Nil	196	...	27	7
Kelantan ...	...	153	62	125	2,102	234	4,142	30	Nil	137	Nil	59	343	789	5,804	...	160	42
Trengganu ...	..	55	50	105	1,240	53	620	Nil	Nil	Nil	Nil	Nil	158	Nil	1,860	..	55	50
Total Malay States	...	17,393	19,389	18,879	214,669	16,140	170,676	30	10	137	68	11,757	21,026	175,926	207,940	...	21,136	17,897
STRAITS SETTLEMENTS																		
Malacca ...	...	3,243	1,421	1,570	15,729	(2) 2,448	(2) 25,346	Nil	21,069	Nil	208,448	2,884	Nil	51,787	Nil	...	5,658	1,264
Province Wellesley	...	102	596	513	5,663			Nil		Nil						...	102	535
Dindings ...	...	127	83	96	1,153			Nil		Nil		5,178		71,332		...	128	91
Penang	714	5,173	9	9	95			788		7,336						1,638	6,230	9
Singapore ...	3,431	32,727	302	182	2,126			8,535		94,942		15,922		220,545		3,099	38,603	287
Total Straits Settlements	4,145	41,372	2,411	2,370	24,766	2,448	25,346	9,323	21,069	102,278	208,448	23,984	Ni	343,664	Nil	4,737	50,721	2,186
TOTAL MALAYA	4,145	58,765	21,800	21,249	239,435	18,588	195,422	9,353	21,079	102,416	208,516	35,741	21,026	519,590	207,940	4,737	71,857	20,083

TABLE II

DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	15,295	34,841	5,836	5,641	951	62,564
WET RUBBER	2,705	3,762	394	247	1,495	8,603
TOTAL ...	18,000	38,603	6,230	5,888	2,446	71,167

TABLE III

FOREIGN EXPORTS

PORTS	For month	during the year 1931
Singapore ...	23,921	338774
Penang ...	7,735	118971
Port Swettenham.	3,749	57,359
Malacca ...	336	4,486
MALAYA ...	35,741	519590

TABLE IV

THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1931
Malay States ...	27,165	413859
Straits Settlements		
MALAYA ...	27,165	413859

Local consumption of rubber during the year amounted to 1,521 tons.

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] — [2] — [3] — [4] — [5] — [9] — [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres. reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 20th January, 1932.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1931.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .05 in or more	Thunderstorm	Fog morning obs	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	86.8	71.8	79.3	93	69	74	74	82.5	83.5	8.76	222.5	1.39	20	18	9			130.10	4.20	35
Bukit Jeram, Selangor ...	86.0	72.0	79.0	90	70	76	74	82.7	84.5	11.99	304.6	1.78	22	18	1	1		167.75	5.41	45
Sitiawan, Perak ...	87.3	72.7	80.0	91	70	77	75	82.5	83.6	15.25	387.4	4.26	24	20	6	4		155.80	5.03	
Kroh, Perak ...	84.0	69.0	76.5	88	65	72	71	78.4	80.7	11.94	303.3	3.33	22	13				174.60	5.63	
Temerloh, Pahang ...	83.4	71.7	77.5	89	70	73	74	81.3	84.0	16.00	406.4	3.82	26	21		9		103.05	3.32	28
Kuala Lipis, Pahang ...	83.7	70.5	77.1	89	67	72	73	80.5	82.5	17.28	438.9	4.36	26	23	1	19		107.70	3.47	29
Kuala Pahang, Pahang ...	82.2	74.0	78.1	86	72	74	76	78.7	80.7	51.14	1305.8	10.58	25	24			5	122.50	3.95	33
Mount Faber, Singapore ...	84.2	73.3	78.7	89	72	76	76	79.7	81.6	11.93	303.0	2.75	23	19	1			103.40	3.34	27
Butterworth, Province Wellesley ...	87.0	73.0	80.0	90	70	74	75	83.0	84.4	9.81	249.2	1.68	18	14	2	1		206.30	6.65	
Bukit China, Malacca ...	83.6	72.8	78.2	88	71	77	75	79.7	82.2	7.19	182.6	1.34	20	17	2			132.60	4.28	36
Kluang, Johore ...	83.4	71.8	77.6	89	70	75	74	79.8	81.6	11.80	299.7	1.79	25	21	1	6		75.45	2.45	20
Bukit Lalang, Mersing, Johore	81.4	72.3	76.9	85	70	75	74	79.0	80.1	30.86	783.8	6.86	26	21				93.45	3.01	25
Alor Star, Kedah ...	83.3	71.8	79.5	90	68	78	74	82.9	84.8	16.23	412.2	2.76	13	13		2	1	214.35	6.91	58
Kota Bahru, Kelantan ...	82.9	72.4	77.7	86	69	76	74	79.8	82.4	39.05	991.9	11.39	20	20				150.95	4.87	41
Kuala Trengganu, Trengganu	82.9	72.7	77.8	85	68	79	75	79.6	80.8	17.95	455.9	6.75	27	22				151.15	4.88	41
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	68.3	58.4	63.3	74	55	61	60			22.27	565.7	3.02	27	23	2		4	89.30	2.88	24
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	69.3	57.9	63.6	73	51	63	62	67.8	68.7	22.48	571.0	3.23	27	25	2	4		92.25	2.98	24
Fraser's Hill, Pahang 4268 ft.	68.4	60.9	64.7	75	56	63	63	69.3	70.6	16.26	413.0	2.22	29	26		29	1	67.70	2.18	18

Compiled from Returns supplied by the Meteorological Branch, Malaya.